ELECTRICAL REVIEW

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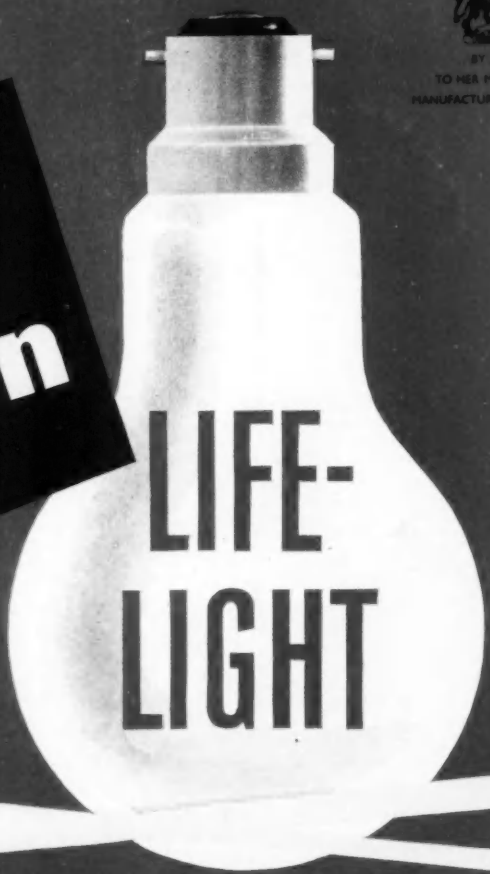

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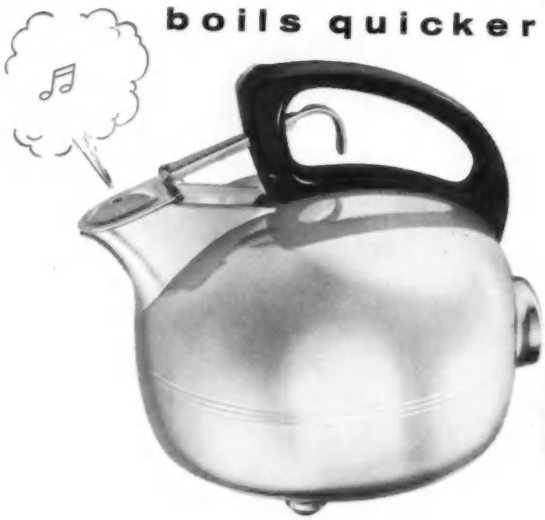

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ELECTRICAL REVIEW

25 September 1959 Vol. 165 No. 7 Established 1872

Street Lighting Co-ordination

THE success of the work carried out by the Consultative Committee on the Lighting of Traffic Routes in the London Conurbation, whose interim report published after the first year's progress is reviewed elsewhere in this issue, will depend largely, as the report suggests, on its wholehearted acceptance by the various local authorities in the area. The Committee cannot be alone in having noticed major changes in the type of lighting installation, and consequent variation in the illumination level provided, when travelling on even major roads crossing boundaries between local authorities. Consultation between adjoining authorities is obviously called for, and although agreed standards for all street lighting schemes are difficult if not impossible to achieve, the final recommendations to be expected from the Committee's work should provide adequate guidance and enable these sudden changes to be eliminated. If adopted the suggestions would assist in reducing drivers' difficulties and contribute to road safety. If voluntary co-operation cannot be achieved, alternative, compulsory, methods may well be introduced, resulting perhaps in the control of highway lighting being removed from local authorities to larger administrative units.

One point considered, the most important according to the Committee, is the difficulty of assessing the relation between the amount of light used and the effect of the illumination achieved when determining the minimum lighting levels for various roads. Since the primary object of lighting is not to emit light but to enable objects to be seen, the suggestion that the present system of specifying the lumen output for a given length of road should be replaced by one expressing lighting in terms of the visibility achieved must be given due consideration. No doubt difficulties will be encountered since, although the basic concept seems to be merely the measuring of the quantity of light reflected from a given surface at some specified distance from the light source, the effects of rain and fog and the use of silhouette lighting techniques will have to be considered. Care would have to be taken in the choice of surface finish in view of the wide variety of road surfaces at present in use. To achieve fully standardised illumination effects—though not necessarily fully standardised installations—it may be that co-operation with such other bodies as the Road Research

Laboratory will be needed to determine ideal conditions for all factors affecting road lighting. Although prescribed for the London area, many of the Committee's recommendations are applicable to all large population centres, but special conditions must of course be given due regard. It is to be hoped that the ideas in this latest addition to the series of publications issued by various authorities dealing with street lighting problems will be accepted, and that the report will provide a basis for discussions on further subjects, for example maintenance.

LIGHTING EFFICIENCY AND AESTHETICS

An important subject to which the Committee does not refer, but which was a constant topic of discussion at last week's A.P.L.E. Conference (see page 339), was the appearance of a lighting installation during the hours of daylight. Technical efficiency must, of course, be the prime consideration but it is clear from the example of the New Towns and from many of the columns and lanterns exhibited at Aberdeen that there is no longer any excuse for installing a system in urban areas that is an " eyesore " during the day.

The public should surely be able to have as much confidence in a lighting engineer's ability to provide an installation that is satisfactory in appearance as they now have in his ability to design it in accordance with the latest technical requirements. As the president, Mr. R. Parker, emphasised, greater attention paid to appearance is an important element in obtaining the backing of public opinion for improved lighting. It might also help if more were done, by comparative installations, to determine the type of lighting that people prefer. Unfortunately, standards of appearance cannot be laid down, but opinion can be informed and judgment developed by experiment and experience.

ELECTRICITY SUPPLY HOURS

The pursuit of the forty-hour week has been taken up by the manual workers of the electricity supply industry whose case was heard by the industry's National Joint Industrial Council last week. It was decided to refer the matter to the Council's Negotiating Committee which is to meet on 21st October. One argument put forward in support of the claim was that the industry could well afford the change, which obviously is expected to add to running costs. Against this it might be said that the customers (who, of course, include the men themselves) should be considered before further commitments are made.

But the claim is only one manifestation of the general move towards a forty-hour week. The five unions concerned are all members of the Confederation of Shipbuilding and Engineering Unions whose demand for the shorter week is already under consideration. It would seem reasonable to await the results of these discussions before conceding shorter hours to sections of the unions involved.

ANOTHER REJECTED TENDER

Last week it was reported that the American General Electric Co. had been told to go ahead with the construction of four turbo-generators for a hydro-electric station at Barkley, Kentucky. Once again the English Electric Export & Trading Co. had put in a lower tender (about £24,000 lower) but this was set aside because of alleged non-compliance with specification.

A spokesman for the English Electric Co. is reported to have said that he was " a little bit suspicious " of the reason put forward for giving the work to the American concern because his company had been building generators and transformers for the United States for some considerable time. Apparently the American authorities have ruled, in the face of representations from American manufacturers, that in each instance tenders shall be judged on their merits. But different authorities may set different standards of merit.

However that may be, the English Electric Co. is to be admired for its pertinacity in the American field which has not been without results in the past.

BUILDERS AND ELECTRICITY

Hitherto there has been a widespread belief throughout the electrical industry that builders are not doing all that they should to give house purchasers the full benefits of electrical service. Answers to a questionnaire by the Federation of Registered House-Builders, recorded on page 322 of this issue, go quite a way towards refuting this charge. The Federation is aware of a growing reluctance on the part of tenants to use solid fuel and in its list of alternatives appears to place electricity first. There is no suggestion that electric heating is too expensive, although it is suggested that equipment could be made cheaper by improved manufacturing techniques to supply a mass market. There is no direct reference to floor warming, but the mention of a trend towards whole or partial central heating indicates something of the sort.

Adequacy of outlets is a subject covered by the questionnaire and the Federation gives a room-by-room schedule of the desirable minima. While electrical people will consider the figures lamentably low in some cases, they are still well above the common provision and show an awareness on the part of builders of the need for proper electrical arrangements.

T.U.C. AND AUTOMATION

Mr. R. Willis, the president, gave prominence in his address at the recent Blackpool meeting of the Trades Union Congress to the fundamental changes now in progress in industry. He recalled the misery caused to thousands of people by the first industrial revolution—the replacement of much manual labour by machinery—and called for the avoidance of any repetition of this in the second industrial revolution—the supplanting of routine " thought processes " by automation and electronics.

Mr. Willis advocated a revision of ideas on industrial relations to meet this new situation. But, of course, since the first industrial revolution there has been a revolutionary change in these relations and in the general pattern of society. Automation is a gradual process and there is already an awareness of possible dislocation. If immediate action is taken to ensure adjustment as automation proceeds there should be little real distress, and even that should be merely temporary. The ultimate result should be a better standard for all.

Wigner Energy in Graphite Moderators

By G. B. GREENOUGH, M.A., Ph.D.*

When a graphite moderated nuclear reactor is in operation a considerable amount of energy can become stored in the graphite. This is known as Wigner energy and it can cause the temperature of the graphite to rise to an undesirable level. To overcome the dangers involved it is imperative to have proper control over this energy. The author explains the mechanism of radiation damage in graphite and after discussing experimental determinations of stored energy at some length he concludes by considering the effect of Wigner energy on the operation of reactors

Of the many problems which the nuclear engineer must face in the design of reactors, those which can be generally classed as "radiation damage" are among the most formidable. These are changes in mechanical, physical or chemical properties and of dimensions which take place in materials when they are exposed to the radiations that necessarily accompany nuclear fission. The radiation most effective in producing the change depends on the property being considered, for instance many chemical reactions are particularly influenced by γ-radiation while the mechanical properties of metals are particularly sensitive to bombardment by neutrons.

Our knowledge of these processes is, in the main, confined to qualitative explanations of the effects. In very few cases can accurate quantitative calculations be made of the magnitude of the change in property to be expected in given conditions of flux, time and temperature. Lest readers should imagine that this lack of quantitative understanding should be confined to radiation damage effects, they should be reminded that metals have been employed for centuries and studied scientifically for decades, yet it is still not possible to calculate the difference in strength of copper and steel. The design engineer relies on a mass of experimental data and on past experience; the nuclear engineer must do likewise and be guided by the qualitative predictions of scientists where data are sparse and past experience negligible. The design must be sufficiently flexible to allow for deviations of the actual behaviour from the estimates on which the design was based.

Radiation Damage in Graphite

Graphite, in common with many other solids, is polycrystalline, that is a piece of graphite is made of a large number of separate crystals. Graphite is distinguished from many other solids in that the crystals are much smaller (and less perfect than in many solids) while the amorphous, or non-crystalline, material sticking the crystals together is thicker than in other materials. It is not thought, however, that these two differences have any direct bearing on the behaviour of graphite under irradiation.

What is important is that in every crystal in the graphite, the carbon atoms are arranged in a regular array. This array is exactly the same in each crystal, and Fig. 1 shows a small part of such an array. This figure makes it clear that the atoms lie in sheets, and within a sheet the carbon atoms lie at the corners of hexagons. The basic reason why the carbon atoms take up these positions during the manufacture of the graphite rather than random positions, or positions with some other pattern, is that this arrangement is the one of "lowest free energy." If the atoms had some other arrangement, they would have a higher potential energy and would have a tendency to revert to the graphite structure. To make this statement in a slightly different way, the atoms in the unusual arrangement have a certain stored energy content, this stored energy being made available when the atoms revert to the normal graphite arrangement.

This is a rather special example of the more general case. In radiation damage we are rarely interested in a complete change of the atomic arrangement of the atoms, but in changes of the position of a small fraction of the atoms; the majority of the atoms remain in their original positions in the crystal lattice. Before discussing this in detail and in relation to stored energy in graphite it is useful to think of the behaviour of graphite in the pile.

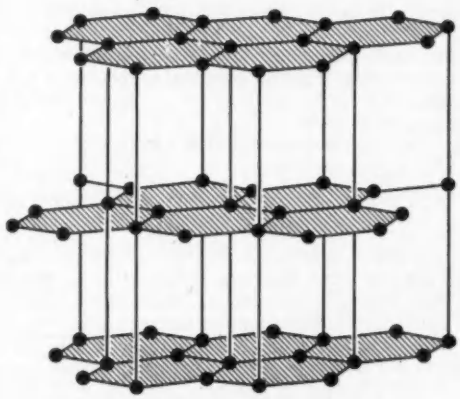


Fig. 1.—Crystal lattice of graphite

If the nucleus of U235 captures a slow neutron, i.e. one whose velocity is such that its kinetic energy is about 0·3 eV, then the atom undergoes fission. A small amount of mass disappears and this is converted into energy. Initially, the energy is either in the form of γ-rays or as kinetic energy of the two fission nuclei and kinetic energy of the two or three neutrons produced. These are moving very rapidly, with kinetic energies of several

* United Kingdom Atomic Energy Authority.

MeV. Most escape from the uranium fuel with little loss of energy. To maintain an easily controlled continuous fission process it is necessary to slow these fast fission neutrons down without losing too many. This is done by the moderator, chosen so that its slowing down power relative to its absorbing power is high. Graphite is one such material.

The actual slowing down process consists of a series of elastic collisions between the neutrons and the carbon nuclei in the graphite. The neutron loses energy to each carbon nucleus it collides with. Some of this energy appears as heat, but some is transferred to the carbon atom. If sufficient energy is given to the carbon atom it may be knocked right out of its lattice position and itself travel through the graphite making collisions as it goes along. The minimum energy required is that required to break the bonds holding the carbon atom to its neighbours, about 25 eV. The neutron, however, is of much smaller mass than the carbon atom, and in order to transfer this energy to the carbon, the energy of the neutron must exceed 100 eV (collisions between atoms and neutrons, not involving absorption, follow the same laws as those between elastic balls). However, this is far less than the initial energy the fission neutron possesses, and thus a great number of collisions are successful in displacing carbon atoms. The carbon atoms when displaced will themselves knock further atoms out of the lattice, in fact this is a much more common source of successful collisions. In the Calder Hall reactors, rough calculations show that every year about three atoms in every 100 in the graphite are knocked out of position.

It is important to remember that neutrons and carbon nuclei are very small compared with the spacing of carbon nuclei in the graphite structure. A neutron may go for two or three cm through the graphite before it chances to hit a carbon nucleus, that is past 10^8 carbon atoms before making a hit. Similarly, the carbon atoms knocked out also travel relatively long distances before making collisions. Thus the atoms knocked out of the crystal lattice by a neutron, either by direct collision or by collisions with secondary "knock-on" carbon atoms, are a long way apart; it seems improbable that there will be more than one displacement in any particular crystal due to one specific neutron.

Fig. 2 is a simple diagram which is drawn in an attempt

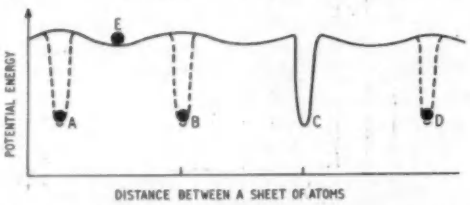


Fig. 2.—Variation of potential energy of an atom with distance through the crystal lattice

to give a picture of events. The sheets of atoms shown in Fig. 1 are perpendicular to the paper, and the general direction of the line is perpendicular to these sheets. The height of an atom above the distance axis shows its potential energy; the atom is thought of as a ball which can roll on the track that is drawn.

Atoms A, B and D are in their normal lattice sites, and are at the bottoms of deep potential walls. These atoms are all in positions of minimum potential energy. However, it is possible to put only one atom in each well, and the potential energy of another atom at that point would be very high. A neutron has made a hit on the atom that was at C and knocked it away, in general to a position many atoms spacings away. This atom E will come to rest *not* in a deep potential well at a lattice point, because there will be none available nearby, but in one of the rather shallow wells that exist *between* the atoms at lattice points. Atom E is thus between lattice sites, i.e. in an *interstitial* atom, and it has left behind it a *vacant lattice site* at C (remember that E and C are far removed from each other in practice).

Interstitial atoms have a higher potential energy than they would have if returned to a vacant lattice site. Thus the state of affairs shown in Fig. 2 represents graphite with stored energy in it. This stored energy would be released, as heat, if atom E returned to the potential well C. This stored energy is the Wigner energy. The quantities of energy that can be stored in the form of these lattice defects can be very large indeed; at the recent Geneva Conference American data presented showed that an irradiation corresponding to a fuel burn-up of 5,000 megawatt-days per tonne would store 630 cal/gm in the graphite in the neighbourhood if its temperature were kept below 30°C all the time. Since the specific heat of graphite is in the range 0·3 to 0·4 cal/gm/°C this stored energy, if it were all liberated, could raise the temperature of the graphite by more than 1,500°C. Clearly, the proper control of stored energy is imperative.

Release of Stored Energy

In a solid, unless it is at the absolute zero of temperature, −273°C, the atoms are all in a state of vibration about their mean position. Thus, in Fig. 2, the atoms should not be thought of as balls stationary at the bottom of their potential wells, but as balls rolling to and fro and climbing a little way up the sides of the well at each end of the vibration. As the temperature of the solid increases, so the average amplitude of the vibrations of the atoms increases. If the crystal lattice were initially perfect, i.e. no vacant lattice sites and no interstitials, apart from this increasing vibration as the lattice was warmed up there would be no movement of the atoms until the atoms had sufficient energy to climb right out of their potential wells; in the simplest case this corresponds to a melting of the solid—the entire crystal structure is lost.

In the graphite shown in Fig. 2, however, the atom E is in a much more shallow well than the remainder. As the graphite is warmed up, this atom will escape from its shallow well long before atoms A and B escape from their lattice sites. Once escaped from the shallow well, it will wander through the lattice, resting momentarily in other wells, until it drops into the deep well at C. Then the stored energy it represents will be released.

Although Fig. 2 well illustrates the principles involved, it is a gross oversimplification of the actual mechanisms. In fact, to understand even some of the more important features of the stored energy release it is necessary to enumerate some of the more important modifications.

In the first place, although at any given temperature the average energy of vibration is fixed for the atoms, there will be considerable variation about this mean for the individual atoms. This is the same thing as saying that at a given temperature the vibrational energy of any one atom will vary with time above and below the average value. Thus, if the temperature of the graphite is brought to a value somewhat below that at which atom E has on average sufficient energy to escape, nevertheless, if the temperature is maintained E will escape sooner or later. At any temperature except absolute zero an interstitial atom in a well of a particular depth has a chance of escaping; its lifetime will be long or short depending on how far below the escape value is the average value

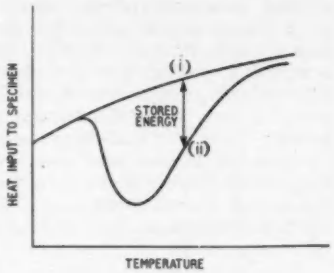


Fig. 3.—Heat required to warm 1 gram of graphite: (i) Unirradiated; (ii) Irradiated

of the vibrational energy. This scientific principle is vital to one aspect of the practical significance of stored energy effects in reactor operation.

In the second place, there is ample evidence to suggest that if a lot of interstitial atoms are allowed to accumulate in the graphite before it is annealed, then many processes can occur other than single interstitials wandering about until they fall into the vacant lattice sites. One is that when the temperature is raised the interstitials may wander through the lattice until they get to the edge of the crystal and anchor themselves there. In practice, this process has little significant difference from the one we have considered; the unfilled vacant lattice site left behind is only of importance when very high temperatures are attained. A more important alternative is that one interstitial can meet a second and form a pair, still lying between the hexagonal planes. This process has the effect of creating a rather deeper potential well between the planes and consequently a higher vibrational energy is necessary to break it up, i.e. the stored energy it represents is not released until a higher temperature is reached than that necessary to extract some of the stored energy represented by the single interstitial.

Experimental Determinations

The mechanics of the process shows that, if the moderator is at a temperature where the mobility of defects is small then, as the reactor operates, more and more defects (interstitial atoms and vacant lattice sites) will be created. The moderator contains stored energy, the difference in potential energy between the atoms in the unusual states and in the normal crystalline state. If the graphite is warmed up the atoms begin to return to their normal sites and the stored energy is released. Because the temperature required to start the defects moving is not the same for all the defects, this is not a sudden process but occurs more or less gradually as the graphite temperature increases.

There are many ways of measuring this stored energy content. One is by measuring the heat of combustion of the graphite. If unirradiated graphite is burned, the production of heat amounts to about 7,800 cal/gm of graphite consumed. This is a measure of the chemical potential energy of the carbon atoms in the graphite lattice relative to their potential energy when in the form of CO_2. If graphite containing stored energy is burned, then this stored energy also appears as heat during the combustion, i.e. more heat is produced when irradiated graphite is burned than in the case of unirradiated material; the difference is the total stored energy content of the graphite.

For research purposes, it is necessary to determine this stored energy to ± 10 cal/gm or better. This is a very small fraction of the normal heat of combustion of the graphite and the achievement of this accuracy requires bomb calorimetry of the highest possible standard. At the Windscale laboratories an accuracy of ± 5 cal/gm can be attained in an instrument developed by Mr. G. F. Jackson.

However, from a practical point of view it is more necessary to discover how much stored energy is released when the graphite is heated through a small temperature interval not far removed from the reactor operating temperature. This is most readily done in the "linear-rise calorimeter," originally designed by Mr. J. H. W. Simmons at the A.E.R.E. and now employed extensively by Mr. J. C. Bell and his team at the Windscale laboratories. In order to eliminate errors the actual apparatus is very complicated, but the basic principles are simple.

Suppose a small specimen of unirradiated graphite is fitted with a small electric heater and a thermocouple, and placed in a calorimeter jacket so that no heat is gained or lost by the specimen except from its own heater (this is ensured by keeping the surrounding calorimeter always at the same temperature as the specimen). If heat is supplied to the specimen, its temperature will rise; the amount of heat required per °C rise will be the specific heat. In fact, for graphite, this is not a constant value but follows the curve shown in Fig. 3, curve (i).

If the specimen is replaced by one of irradiated graphite, and the experiment is repeated, the energy stored in the graphite, and released during the experiment, will help to warm the graphite; less heat will be required from the heater, Fig. 3, curve (ii). The difference between the heat supplied in this case, and in the unirradiated case, is the stored energy release rate for the specimen. For the case in Fig. 3, the curve of the stored energy release rate *v.* temperature is given in Fig. 4. It is important

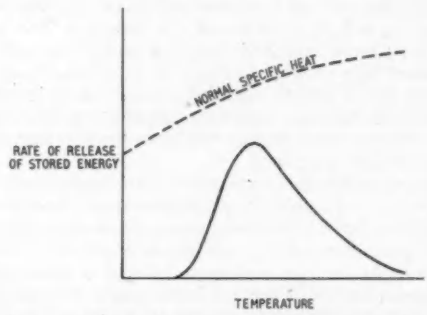


Fig. 4.—Rate of release of stored energy with increasing temperature for the irradiated specimen shown in Fig. 3 (ii)

to note that the rate of release of stored energy is dS/dT, where T is temperature and not time; throughout the following this meaning should always be attached to the quantity "rate of stored energy release."

One of the complications of the apparatus is that in some specimens the rate of release of stored energy is greater than the specific heat. Thus, to keep the temperature of the specimen rising slowly (2°C per min is an arbitrarily chosen standard rate), heat must be removed from the specimen. Nevertheless, the principle involved is the same. Typical curves for graphite taken from different parts of the Windscale reactor are shown in Fig. 5 and the relevant data are given in Table I.

One point is immediately obvious. For some of the specimens there is a temperature range where the rate of release of stored energy exceeds the specific heat. In the specimen represented by curve A, for instance, when the temperature is taken from 150 to 151°C, the stored energy release is 0·42 cal/gm while the specific heat is 0·25 cal/gm. Thus, the stored energy release rate is more than sufficient to heat the specimen without

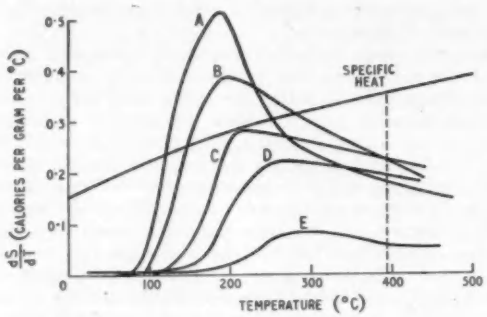


Fig. 5.—Rate of release of stored energy for samples irradiated at points along a channel in the Windscale reactor (see Table I)

TABLE I.—IRRADIATION DATA FOR CURVES SHOWN IN FIG. 5

Neutron dose (rel. values)	Temperature of irradiation (deg C)	Curve No.
0·39	30	A
0·81	50	B
1·00	80	C
0·95	105	D
0·51	145	E

any outside help in this temperature interval. For this particular specimen this state of affairs starts at about 120°C where curve A first crosses the specific heat curve. Thus, if a specimen of this graphite were warmed not too slowly to 120°C and then allowed to run adiabatically, i.e. no heat was added or removed from outside, its temperature would rise rapidly. The maximum temperature reached can, very crudely, be taken as the dotted line on Fig. 5 chosen at a position such that the total stored energy released equals total heat energy required, i.e. the area under the specific heat curve from 120°C to this line equals the area under the stored energy release rate curve.

This behaviour can be observed in a very simple way. If a specimen of unirradiated graphite is put in a furnace running at 200°C, the temperature of the graphite will come up to the furnace temperature. This is shown by the dashed curve in Fig. 6. But if a specimen of irradiated material is treated in the same way, then the full curve is obtained if its stored energy release rate curve is similar to curve A.

Having noted that these spectacular effects can occur in the moderator, the next important question is how likely are they to happen in normal reactor operation. Work done on the Windscale and BEPO reactors, and discussed in the final report of the Fleck Technical Evaluation Committee, shows that large volumes of graphite have appropriate stored energy release rate curves. Thus, whether the effect will occur in practice depends on reaching the "triggering" temperature, that at which the rate of release of stored energy first exceeds the specific heat. The data in Table 1 and in Fig. 5 show that the temperature interval between irradiation temperature and the triggering temperature is about 80 to 100°C, i.e. for these specimens the graphite must be warmed appreciably by some means other than stored energy before the self-sustained release will start.

From a consideration of the mechanism of the damage and its annealing given earlier, it is certain that this temperature interval will always occur. It was there pointed out that the vibrational energy of the atoms varies with time at any temperature. Thus, a defect which will be released in a few minutes at 100°C because the average vibrational energy is then sufficient to jolt it out of its trough, is likely to disappear if the temperature is held at 50°C for a few months. It takes many months' operation to produce curves of the type shown in Fig. 5. Operationally, one is interested in temperature changes occurring over relatively short periods, e.g. minutes or hours. Thus it is that there are no defects which can be removed in the short times of interest until the temperature has been raised by more than 50°C above the normal operating temperature. This will always be the case in graphite irradiated to any dose and at any temperature.

Other points are less obvious, but equally important. One is whether the curves shown in Fig. 5 account for the bulk of the stored energy in the graphite. At very small irradiation doses, in fact, they do. But at the dose levels one reaches in large reactors in a few years, it is found that only a fraction of the total stored energy is released by taking the graphite temperature to 450°C.

Extensive studies of the general form of the stored energy release rate curve after various irradiations have led to the conclusion that the large "peak" in the curve at 150 to 200°C is the result of moving single interstitials from between lattice planes, either to vacant lattice sites or to make pairs of atoms as described earlier. The lower part of the curve, which probably continues up to at least 1,000°C, represents the energy released when the more complex groups of interstitials break up.

The curves shown in Fig. 5 reveal the very important effect of irradiation temperature. Comparing A with E, where the irradiation temperatures are different, reveals that the energy stored during irradiation at a higher temperature is very much less, although the neutron dose is significantly higher. This is true for the rate of release curve at 400°C, i.e. well above the irradiation temperature in either case.

This is to be expected. At the lowest irradiation temperature of 30°C, the interstitials produced by the radiation are not very mobile and take a long time to move. Thus, at any time there will be quite a high concentration of these single interstitials in the crystals. This being so, the probability of two interstitials meeting and forming a more stable pair is quite appreciable. After irradiation, there will be a large "peak" of stored

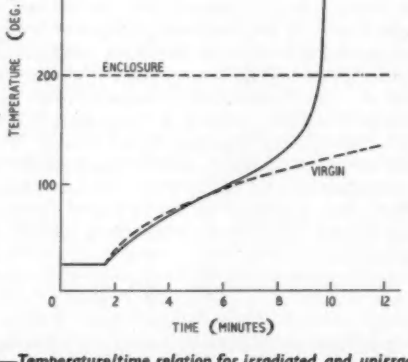


Fig. 6.—Temperature/time relation for irradiated and unirradiated graphite placed in an enclosure at 200 deg C

energy release, due to the single interstitials, and an appreciable stored energy at higher temperatures due to breakdown of the pairs of interstitials, etc.

At the highest temperature, 145°C, the single interstitials are much more mobile and, despite the fact that the rate of production by the higher flux is greater, the concentration of single interstitials at any instant will be low. Therefore the rate of production of pairs of interstitials by the chance meeting of two interstitials is also low. After irradiation, then, there should be only a vestige of the low-temperature peak due to single interstitials, and a quite low background due to pairs, etc. The figure confirms this picture.

Wigner Energy and Reactor Operation

It is clear that there is a limit to the temperature the moderator can be allowed to attain during any possible circumstances. This temperature is set either by the graphite itself, or by the fuel properties, or by some other component of the reactor. In practice, the limitation is likely to be one of the first two. Having fixed this temperature it is necessary so to deal with the stored energy as to keep below this limit.

From what has been said before it is clear that there are several ways of dealing with the stored energy problem:—

(a) Keep the graphite so hot during irradiation that single interstitial atoms are very mobile and disappear so quickly that the probability of forming pairs and bigger complexes of interstitials is negligible. Irradiation temperatures of about 250°C are likely to be required for this.

(b) Control the temperature of the moderator so strictly that it will never, in any circumstances, rise above its normal operating temperature sufficiently to reach the triggering temperature; i.e. although a release of stored energy would raise temperatures to a dangerously high level such a release is prevented from occurring.

(c) Anneal the stored energy periodically so that, although it builds up quite rapidly, it never attains a large value.

It is unnecessary to say that (a) is the most desirable, provided that the attainment of the temperature necessary does not introduce other problems. Even if the reactor temperature is not high enough to prevent completely some accumulation of stored energy, it is desirable that the temperatures should be as high as possible. Fig. 5 indicates how this will increase the periods between anneals. The fact that Calder Hall has moderator temperatures much higher than BEPO and Windscale means that the stored energy presents a much smaller problem in spite of the more intense neutron bombardment.

In reactors such as BEPO, Windscale and some American air-cooled reactors, built before these problems were thoroughly understood, the alternatives are (b) and (c). Running the reactors under strictly controlled temperatures, the alternative (b) is feasible. However, the Fleck Committee did not recommend such a method for Windscale because of the continuous vigilance and lack of flexibility in operation that it implied.. The Committee recommended that the previous practice of annealing the reactors periodically should be continued, but that the anneals should be conducted differently to ensure a closer control on the temperatures reached.

The earlier practice had been to heat the graphite by nuclear heating with the pile coolant air shut off until the temperature of the graphite reached the triggering temperature, i.e. the point where the rate of release of stored energy curve crossed the specific heat curve. The graphite then heated itself "adiabatically" and the release spread through the pile. This practice had the advantage that no equipment was needed other than that necessary to run the pile normally and to monitor the temperatures during the release, and that it was a relatively speedy task. Many successful releases were performed at Windscale and one on BEPO by this technique.

However, the method had three drawbacks. The first was that the nuclear heat was not produced where it was required—from Fig. 5 this is clearly the part of the graphite normally coldest, i.e. away from the position of maximum flux. Thus, the fuel temperature had to be raised to a relatively high value. The second was that the anneal tended to start at one point where the nuclear heating was most effective and spread by conduction; in a pile such as the Windscale reactor which contained gaps between the graphite blocks in the moderator to allow for radiation induced dimensional changes, this inevitably left unannealed pockets. The third was that since no

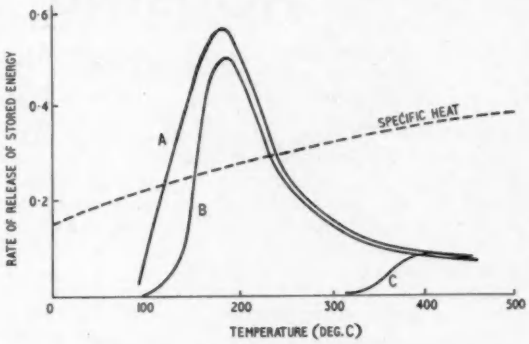


Fig. 7.—Rate of release of stored energy for samples at three stages of energy release method proposed for Windscale reactor No. 2

cooling air was flowing, the operation of burst cartridge detection gear was impossible.

The first change in method was that used in BEPO in March, 1958, when the initiation of the release was by heating the moderator with air warmed by blowing it through electric heaters placed in the coolant ducts. This successfully overcame the three objections raised in the preceding paragraph, and the anneal was carried out with complete success.

For Windscale No. 2 reactor, however, an additional problem was present. It seemed possible from the records kept of previous anneals on this pile that some areas had escaped one or more of these anneals. If an anneal were initiated in these areas, then the temperatures would rise above normal, and possibly to a value higher than the maximum value permitted, viz. 400°C. The Fleck Committee faced the problem of how to reduce the maximum temperature in those regions. The means by which this was to be done is as follows:—

If a specimen of graphite is heated to the triggering temperature and is unable to transfer heat to the surroundings, it will behave as in Fig. 6. But if heat is removed from it continuously, then its temperature can be controlled. In small samples this is done in the linear-rise calorimeter described earlier; the samples are made to rise in temperature at 2°C per minute irrespective of the stored energy release rate. This can also be done in a moderator stack, although it is very difficult because heat can be removed from the graphite only by the air blowing through the coolant channels. Heat developed

in the centre of a graphite block must first be conducted to the wall of the channel and then transferred to the air.

Calculations and experiments by teams at Windscale and Harwell showed that if the rate of rise of temperature of the graphite were ½°C per hour, then the graphite temperatures would never exceed the air temperatures by more than a few degrees. Thus, a way was open to anneal the pile even if the adiabatic case would lead to unacceptably high temperatures. Scientifically, an admirable method was to blow air into the pile whose temperature was raised at ½°C per hour from 50 to 200 or 300°C. This would undoubtedly have given a safe and effective anneal. Unhappily, the concrete structure of the pile cannot stand such high temperatures for such long times. Therefore, a compromise was suggested where the pile was first conditioned by the slow heating method, to remove some of the stored energy, and then triggered by raising the air temperature rapidly and allowing the graphite to release the remainder quasi-adiabatically. Fig. 7 shows the stored energy release rate curves after the various stages:—

(i) Before the release.
(ii) After the initial conditioning treatment to 110°C at a rate of rise of ½°C per hour.
(iii) After triggering, when the temperature reaches 300°C.

However, as has been announced recently by the Authority, the cost of the modifications necessary to permit this method of release and the associated new equipment is so high as to make the operation of pile No. 2 uneconomic, and the method will not be employed.

Figs. 5, 6 and 7 are reproduced by courtesy of Mr. J. C. Bell and his team at Windscale.

HOUSING STANDARDS

Builders' Views on Electrical Provisions

THE Central Housing Advisory Committee's Sub-Committee on Housing Standards has prepared a questionnaire for completion by interested parties. Among the latter is the Federation of Registered House-Builders (affiliated to the National Federation of Building Trades Employers) which has sent us a copy of its answers to the questions put by the Sub-Committee.

Replying to questions about heating the Federation notes a strong trend for whole or partial central heating independent of the living room fire which may remain for a time as a traditional focal point. The trend is away from solid fuel and towards space heating by electricity, oil or gas. Electricity is believed to have the strongest appeal on the grounds of cleanliness, automatic control and the possibility of economy in the foreseeable future.

The indications are that there will be a growing demand for whole-house heating systems for houses costing above £2,500. Capital and running costs of such systems should be reduced by mass production methods in manufacture, efficient design and intelligent use. Stress is laid on the need for effective heat insulation.

Upon the subject of the size of kitchens the Federation says it has welcomed the decision of the British Standards Institution to set up a committee to consider the principles of kitchen planning and the co-ordination of sizes of domestic appliances and equipment. It is considered that laundry work can be carried out in the kitchen satisfactorily if reasonable attention is paid to ventilation and timing. Where space is to be provided, but not the equipment itself, there should be provision for cooker, refrigerator, washing machine, spin dryer and ironing board. The Federation reports mixed views from its members upon the advisability of placing laundry facilities in the bathroom. There are possible dangers from the use of electrical equipment in such a case although, it is said, "with proper and adequate wiring this point would have little validity."

Another question asks about the position of kitchens in relation to sunshine or shade. The Federation suggests that the increased use of refrigerators enables a more pleasant and interesting outlook to be provided irrespective of sun and shade.

The Sub-Committee is seeking advice on the adequacy of electrical (and gas) installations. The Federation's view is that while present provision is thought to be adequate there is some demand for increasing it. It is emphasised that "nothing should be done to invalidate the freedom of choice of individuals as between one source of power and another where they can be made available." The Federation then proceeds to specify the desirable minimum provision of electrical points as follows:—*Kitchen.*—One cooker control unit, two 13 A power points, one or two lighting points. *Dining room.*—One 13 A power point, one lighting point. *Lounge or living room.*—Two 13 A power points, one or two lighting points. *Hall and landing.*—One 13 A power point, one lighting point. *Bedrooms.*—One power point, one lighting point. *Bathroom.*—One lighting point. *Linen cupboard.*—One power point for immersion heater. *Garage.*—One lighting point. Provision of television aerials is also suggested.

Asked for its views on safety, the Federation says that while electrical services and equipment as arranged for by competent designers and installed by competent contractors are safe, it should be stressed that special care is needed in regard to the use of electrical appliances near water. Electric power points should be of the shuttered type. Listing suggestions for improvements in order of importance the Federation puts heating and insulation first, kitchen planning and equipment second, and electrical points sixth (and last).

ELECTRICITY SUPPLY IN 1958–59

The annual reports and accounts of the Electricity Council, the Central Electricity Generating Board and the twelve Area Boards for the year ended 31st March last are to be published on Tuesday, 29th September. Next week's *Electrical Review* will contain a summary of the year's operations, with tables covering generation, sales, financial results, etc. The following issue will include a review of the Area Boards' reports

Electronics Applied to Industrial Instrumentation

By N. J. DAY, M.A., G.I.Mech.E.*

The progress and development of electronic techniques and apparatus have enabled a wider use to be made in industry of electronics for instrumentation and control. Photo-electric and stroboscopic equipment and the use of ultrasonics are among the subjects that are dealt with in this survey and the instruments reviewed include those employing radiation techniques

IN the past decade electronic instrumentation in industry has progressed so rapidly that any attempt to describe fully all the applications would involve several large volumes, and in this article it is therefore proposed to carry out a broad survey and review the types of instruments which are in current use.

Electronics as an aid to measuring was foreseen several years ago, but it was not until improvements had been made in valve and component manufacture, better power supply stabilisation had been achieved and the technique of negative feedback discovered, that any real advance could be made in electronic instrumentation for industrial research and process control work.

Industry did not readily accept electronics and had to be educated in the application of this new medium. Today, however, the word "electronics" has sales appeal —to such an extent that it is sometimes applied to devices which are only partially electronic. An electronic instrument, by definition, depends upon electronic emission or ejection and the amplification and measurement of the signal to operate controls, recorders and other devices.

"Nucleonic" instruments also are invariably referred to as "electronic" and there is sufficient "electronics" in these instruments to justify their appearance in this article, for, although a radioactive source is employed, electronics is required to detect and amplify the charged particles.

It would be a tremendous task to list all the industries which have found electronics so invaluable but the examples quoted will serve as a guide to show the type of application possible both in the research laboratory and in the testing, inspection and control of the manufacturing process. Electronics is already proving itself superior to other methods, being more convenient, precise, and adjustable to automation.

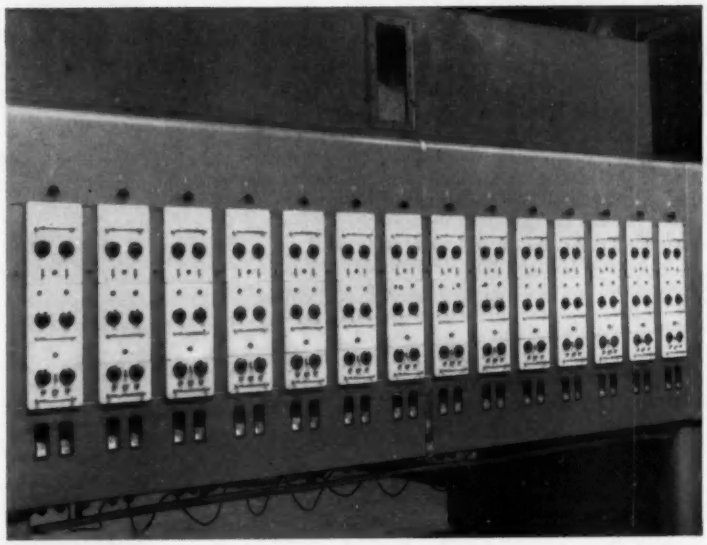
Credit for the many and interesting applications of electronics is not entirely given to the ingenuity of the instrument manufacturer, for a large measure must be accorded to the industrial user himself, who alone can see further adaptation of electronic techniques to his own particular work. Instruments are often manufactured in collaboration with users who want an automatic device to do a certain job. For example, what instrument maker would have foreseen the possibility of an audio frequency oscillator being used, in a laboratory undertaking research for the manufacture of new insecticides, to confine pests to plants.

Photo-Electric Devices

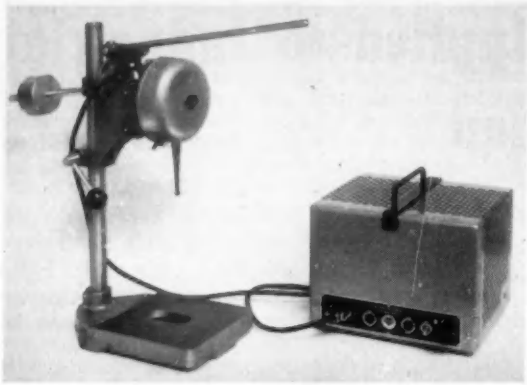
Many industrial devices employ photocells and one of the simplest applications is that of counting. This is particularly useful where the items to be counted vary in shape and size, and do not lend themselves to any form of mechanical counting. Items can be counted at tremendous speed and simultaneously into batches of a preselected number. Batch counters may be used also for measuring specific lengths or weights, with the addition of suitable auxiliary equipment. To avoid errors due to multiple counting, as may be incurred when counting irregular articles, the input circuit may be paralysed for a known period. Batch counters have also been effectively applied in confectionery factories where the weighing of sweets for packaging has been the problem. Instead of being weighed, the sweets are counted, a certain number corresponding to the required weight to fairly close limits.

Electronics also plays a very important role in sorting

* W. G. Pye & Co., Ltd.



Automatic bean sorting machine



A 50 W ultrasonic drill

according to colour. A particularly useful application of this is to be found in the food canning and seed packaging industries, where it is often found necessary to sort discoloured items such as stained beans or peas from the main bulk. To conserve space, sorting machines are arranged in cabinets of 10 to 14 units, each cabinet incorporating a common feed hopper and discharge conveyor. In each unit, seeds are fed in single file to an illuminated viewing head, where they are individually inspected by means of a photo-electric cell. The cell gives out a signal dependent upon the amount of light reflected by the seed, compared with the light reflected from the background of the viewing head. As the illumination of the background is infinitely variable, it is possible to achieve a very high degree of selection. If the seed is darker than the background, a signal is fed via an amplifier to a circuit which triggers a reject mechanism.

Other industrial applications of electronic instruments employing photocells include the checking of colour registration in printing and the warning of a break in a roll of paper which, if not noticed on a high-speed machine, could result in the accumulation of waste and the loss of valuable production time. Machines can be controlled, where repetitive processes are being carried out, by a photo-electric cell and a disc, slotted at various intervals around its circumference, geared to the machine. This disc acts as a variable shutter in the light beam and can thus control relays to carry out machinery processes.

Smoke detection and control are successfully achieved by photo-electric cells and this is a useful application both in the case of fire outbreak and also in controlling and recording smoke density in a chimney to ensure full fuel combustion economy and prevent infringement of the law in connection with atmospheric pollution. Many safety devices on machines incorporate a photocell which operates instantaneously when the light beam is broken or transmitted, and photo-electric devices may be used to control the opening and closing of doors, machine guards, etc.

Photo-electric instruments are found in the research and testing laboratories of many industries for use in colour problems. Colorimeters are used to make comparative measurements on coloured solutions, and absorptiometers assist in the comparison and standardisation of liquids for the equality of light transmission, while in the manufacture of photographic film and plates, etc., a densitometer is used. The opacimeter measures the opacity of papers and other materials, employing a photocell to measure the amount of scattered light passing through a given area of the material, and the glossmeter examines and compares similar surfaces, assessing the surface polish on ceramics, paint, paper, etc. The spectrophotometer ensures accuracy regarding colour composition and the maintenance of a uniform standard.

Stroboscope Devices

The stroboscope has been applied to numerous processes in industry. In printing, registration is carried out at speed, but the stroboscopic lamp emitting a series of flashes is synchronised with the speed of the press and creates the illusion that the printing matter is at a standstill. Inspection can thus be carried out at high speed and correction made without stopping the machine.

A stroboscope is used with dynamic balancing equipment. Any unbalance which occurs when an armature rotates at high speed causes vibration of the cradles supporting the armature. This vibration is transmitted to pick-up coils mounted in a magnetic field, resulting in an alternating voltage being generated proportional to the amplitude of the vibration of the armature; this is fed to an amplifier and output meter. A filter network passes only those vibrations which occur once per revolution. The stroboscopic lamp gives a pulse of light each time the voltage in the pick-up coils changes from negative to positive and in this way flashes in synchronism with the vibration caused by the unbalance. The stroboscope causes the armature to "freeze" and one of the numbered gradations previously placed on the armature can be read quite easily, indicating the angular location of the unbalance. Unbalance corrections are generally made in two selected transverse planes and a control switch selects either the right- or left-hand plane of correction; unbalance readings in one plane are not affected by unbalance in the other plane.

Another type of stroboscope, with a range of 10 c/s to 10 kc/s, permits inspection up to very high audio frequencies. Typical applications are the detection of resonance in the electrodes of thermionic valves when

Stroboscopic equipment being used in rotor balancing

subject to vibration, and the study of gramophone pick-ups, loudspeakers, etc. A slow-motion stroboscope allows the part under vibration to be viewed in slow motion at any selected speed up to 2 c/s, irrespective of the drive frequency.

Ultrasonics

One of the most common applications of ultrasonics is that of measuring thickness. An ultrasonic wave is passed through a material of reasonable thickness and reflected from the opposite face. At certain frequencies the injected and the reflected wave will be in phase and there will be a relatively large increase in amplitude of the wave. When this occurs the material acts as a resonator.

Since the velocity of sound in most materials is accurately known and the fundamental resonance frequency easily found, the thickness of the specimen can be determined. This form of thickness measurement has proved invaluable in measuring inaccessible objects, bends in pipes carrying chemicals, the thickness of acid tanks during manufacture, checks on spheres containing fuel gas, the thickness of evacuated glass, pressure refining vessels, etc., and precision engineering components, such as aircraft propellers.

Ultrasonics is also widely used to determine flaws in materials. When a fault is present some sound returns from the opposite face and this can be displayed on a cathode-ray tube, or made to operate an alarm system if continuous and automatic inspection is being carried out. Ultrasonics has been successfully applied to new soldering and tinning techniques, and to the precision drilling of such hard and brittle materials as glass, ceramics and tungsten carbide, working on a principle similar to that of a pneumatic road drill, but with 20,000 vibrations per second. Because of this action such drills are not limited to circular holes, but will produce holes of any desired shape.

Small components such as watch mechanisms, miniature motor parts, transistor component parts, miniature ball races, valve components, etc., may also be cleaned using ultrasonic equipment. Liquid in a bath is vibrated at about 40 kc/s and cavitation bubbles are produced. The build-up and collapse of these minute vacuum bubbles results in a violent and intensive scouring action on the surface of any object immersed in the bath, without mechanical detriment. Ultrasonics enables cleaning to be carried out in cavities, grooves and other inaccessible places. Complete assemblies can be immersed and the parts cleaned thoroughly within a matter of minutes.

Industrial pH Meters

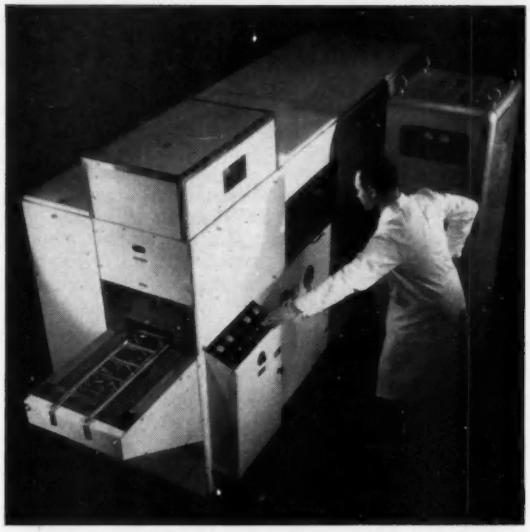
The direct reading pH meter has found ready application in numerous industries and three types are available —the laboratory model, the portable and the industrial. Basically, the pH meter is an electronic amplifier with an indicating meter giving a direct reading of pH, and electrodes which are inserted into the specimen under test.

Recorders, monitors and alarm relays can be operated by the meter, an extremely useful feature for many industries where the control of a manufacturing process has to be kept to very fine limits. The modern industrial pH amplifier operates under the widest range of factory conditions, giving better product quality and a considerable saving in labour and plant maintenance costs. The indicating meter and recorder or alarm system can be situated at a remote distance in a control room and any deviation from a set pH value of the process can be corrected automatically. In the case of effluent the system can operate a device for closing the outlet until sufficient neutralisation has been achieved for the ejection of the waste. Effluent control and flue gas analysis are two of the most pressing problems in the steel industry.

In the laboratory the pH meter can be used for research, and can also be combined with an automatic titrator for carrying out oxidation/reduction reaction tests. The determination of the sulphur content of bitumens, oils, etc., can be carried out automatically with a special instrument, based on automatic titration, which has found particular application in oil refining.

Argon Chromatograph

A comparatively new analytical technique now looks to electronic means to provide greater sensitivities. The latest type of instrument—the argon chromatograph—has harnessed both nucleonics and electronics to give a



A large ultrasonic cleaning plant

sensitivity some 100,000 times greater than that obtained by previous methods, and it is finding extremely useful application where the swift and accurate analysis of complex organic substances is required.

A unique feature is the use of argon as the carrier gas, excited into its metastable state on entering the detector. The excitation energy of argon is 11·6 eV and as this level is higher than the ionisation potential of organic vapours, any such vapours present in the carrier gas are ionised on collision with excited atoms as they enter the detector, causing a considerable increase in current through the cell. Furthermore, the electrons emitted when organic vapour molecules are ionised are able to enter into the process of producing more metastable or excited argon atoms. Such an effect depends upon cell voltage, so that with an increase in voltage greater sensitivities are obtainable. The sensitivity range is approximately one part component in 2×10^{6} to 2×10^{3} parts of carrier gas for full-scale deflection on the recorder, and the limit of detection is one part component in 2×10^{8} of carrier gas.

Minute samples in the order of 0·1 microlitre to 0·025 microlitre are inserted quite simply by a micropipette. The small size of sample allows a smaller proportion of liquid phase to be used and, as a result, column efficiencies

in the order of 1,000 theoretical plates per foot length of column are obtainable.

Monitoring and Scanning Devices

In the production line many electronic instruments provide an accurate and reliable means of testing the contents of packets and containers, and rejecting any which are empty or only partially filled. A radioactive detector records the absence of an obstruction and causes an ejection device to discard the empty carton. The radioactive source, usually a thallium or strontium type, is mounted on one side of a conveyor and the articles interrupt the radiation beam as they pass, forming a barrier between the radioactive source and the detector opposite. A correctly filled container will only allow the radiation beam to penetrate to a certain degree, but if the contents are below a preselected quantity, sufficient rays from the isotope will reach the detector tube and the resulting signal is amplified to operate a reject system. The detector tube can be adjusted to accept a limited degree of radiation, and will respond to variations in either direction. Thus it can be set to control to very fine limits the correct filling of a container.

When the monitor is inspecting packing lines where a gap exists between the packets, a photo-electric cell is incorporated in the equipment. This detects the obstruction instead of its absence, and when a package passes through the light beam it automatically switches on the monitor, switching it off again when the object has been examined. The monitor can therefore operate whether the containers flow in a continuous stream or intermittently. Tablets and pills can also be monitored even when inside a sealed carton.

Metal Detector

Industrial electronic metal detectors sense the presence of any metal, ferrous or non-ferrous, in any non-metallic material. One equipment can cover a maximum of six conveyor lines, with individual control of each line, and its application ranges over a wide variety of industries. The search head, under which the products to be inspected pass, contains three coils, one known as the "oscillator" coil and the other two as the "pick-up" coils, so arranged that there is an electrical balance between them. When any metal particle enters the field existing in the aperture, the balance is upset and a minute voltage is induced in the two "pick-up" coils. This is amplified and passed to the power unit which operates a relay and, in turn, an alarm or ejection system.

There are several methods available for identifying the article or package containing some metal and removing it automatically from the line without hindrance to the production flow. One system is an automatic delay unit which is basically a "mechanical" memory that stores the pulse generated by the alarm relay and releases it later to operate a solenoid when the article containing the metal arrives at a flap or ejector.

Thickness and Weight Control

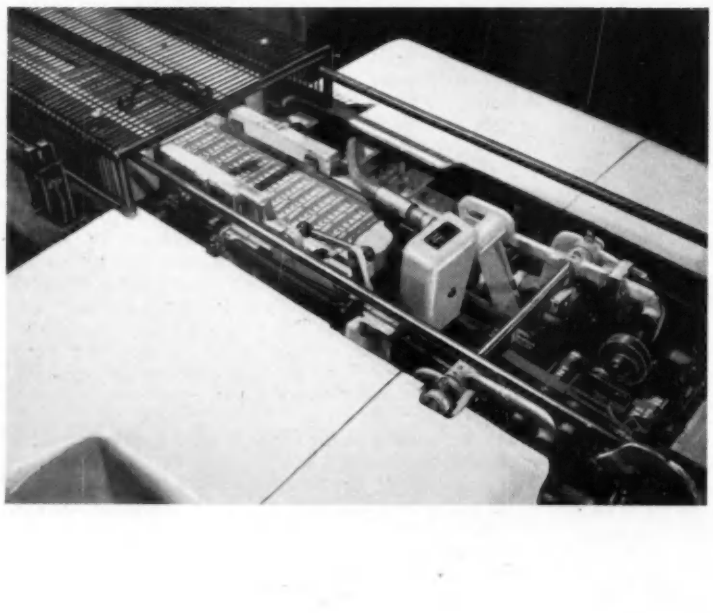
Radiation gauges play an extensive part in controlling the thickness or weight of material in the paper, metal-rolling and plastic industries, and they are also used to control the coating of materials. In operation, beta or gamma radiation, consisting of fast electrons from a radioactive source, or X-rays, are directed at the sheet of paper, metal or other material; part of the radiation is reflected or scattered, part is absorbed and the remainder transmitted. The radiation which emerges on the other side of the sheet gives a measure of its weight per unit area, and this is finally determined when the amplified ionisation current, derived from the detector upon which the transmitted radiation falls, operates an indicator instrument.

The intensity of both reflected and transmitted radiation changes with the weight per unit area of the sheet and the atomic number of the elements of which the sheet is composed, so that both effects depend intrinsically on mass or weight rather than thickness. The gauge therefore can be calibrated in terms of thickness where the density of the sheet is known and constant as in the case of metals and most plastics. However, in the case of material in which the density varies, such as paper, carding, etc., the gauge is usually calibrated in terms of weight per unit area. In some cases, such as chipboard and resin bonded materials, the thickness is known and an indication of density is required. The gauge can be calibrated in units of density and serves to check whether the mould has been adequately filled as well as to indicate the presence of air cavities.

A back-scatter gauge is used to measure the weight per unit area of a layer of coating material against a background of some other material. For the success of this method it is essential that the mean atomic number of the coating or material to be measured and the base or background material are appreciably different. Both the source and detector are fitted on the same side of the strip for, in this case, it is the reflected radiation which is measured. An important application of this technique is the non-destructive testing of dip-tinned steel sheets where an accuracy of ±0·000002in or ±2 per cent of the tin coating can be readily obtained.

A differential gauge is also used on coating machines. This has one measuring head over the ingoing uncoated web or base material and another over the outgoing coated web. A change-over switch is provided so that the instrument can be used to measure the difference, i.e. coating

Carton contents being inspected by a package monitor



alone, ignoring variations in base weight, or to check the weight per unit area of the ingoing base.

In paper and board manufacture there are sometimes as many as six measuring heads, three across the dry end and three across the wet input end. The input end weight can be controlled to remain constant as long as the moisture content at this end is substantially constant. The input end gauges are only responsive to total weight, water plus solids, and cannot by themselves measure or indicate moisture content. However, corrections can be made if the moisture content has been misjudged when the board reaches the dry end gauging points and the indicators show up any residual errors.

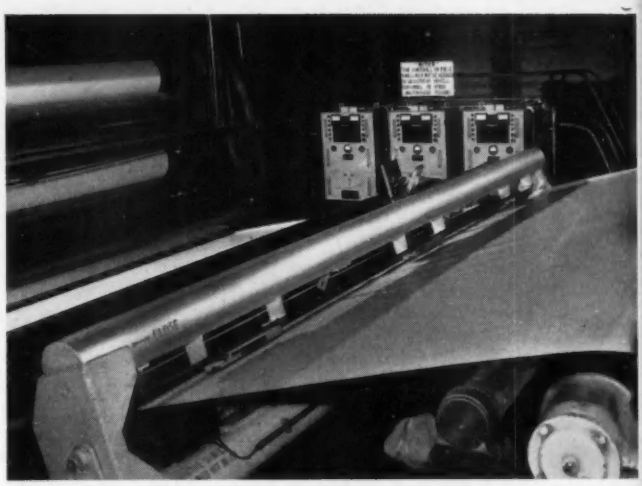
Induction Heating

Radio frequency or induction heating is nowadays being more widely used for the heat sealing of both metal and non-metal containers. In the various canning industries the tops are placed on the filled tins together with a thin round of solder. As they pass along the conveyor beneath a coil, electromagnetic induction causes the solder to melt and seal the container. In the case of non-metallic materials an electrostatic field induced between two plates heats the adhesive medium or, when thermoplastics are used, joins two pieces or two coated surfaces by welding. The latter method is becoming very popular in packaging, and labels, paper bags, etc., now have thermoplastic coatings where the seal is to be made. Its great advantages are speed, cleanliness and neatness.

Induction heating is applied to metal treatments involving heat, including hardening, tempering and brazing. It is also employed in the heat treatment of wood, especially where glueing is concerned, and the textile and plastics industries.

Level Control

Many industries have had problems of level control, but today electronic means are available for giving an accurate and reliable indication of the level of any material whether solid or liquid in a variety of containers. One method of control is based on the principle of electronic capacity. The change in capacitance caused by the approach of any substance to, or its recession from, a probe, is made to operate a relay, which can either operate an alarm or control the feeding mechanism. A range of electrodes is available for use with all types of material, whether water or corrosive acids, powders or solids at varying temperatures and pressures.



Three-channel substance gauge installation on the dry end of a paper/board machine

Another method uses nucleonic/electronic detection. A beam of gamma rays from a radioactive source mounted on one side of the vessel passes through the walls and falls on a detector unit on the other side. The detector signal varies according to the level changes and subsequently the signal is amplified to operate an indicator, chart recorder or an automatic controller.

This broad survey of electronic instrumentation shows that electronic developments and techniques are finding still wider applications. There is still need, however, for greater co-operation between industry and the instrument manufacturer in order that problems may be solved either by adapting existing techniques or determining others.

NEW BOOKS

Semiconductor Abstracts. Vol. IV. Edited by E. Paskell. Pp. 456. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 96s.

This fourth volume of abstracts of published literature on semiconducting and luminescent materials and their applications is in fact the 1956 issue, though, as explained in the foreword, the delay in its appearance is due to the fact that its preparation has been a voluntary effort by the staff of the Battelle Memorial Institute, Ohio, U.S.A. Abstract journals have been used as the principal source of material, although original articles have also been reviewed and personal coverage made of some papers presented at society meetings, including papers read at the meeting of the American Physical Society and also the Electrochemical Society, the sponsors of this publication.

Germanium; silicon; carbon, selenium and other elemental semiconductors are first dealt with, followed by sections on intermetallics, such as aluminium, caesium and gallium antimonide; sulphides, selenides and tellurides; oxides and halides. The abstracts dealing with materials are concluded by sections on arsenates, phosphates, silicates and tungstates and on organic materials. The final section is devoted to abstracts on theoretical matters, including crystal growth, conductivity, physical effects and luminescence, concluding with a number of brief book reviews. Although most information can be located from the contents table, a cross-reference subject index and author index are provided.—T.R.W.

Electrical Installation Calculations for Second and Third Year Students. By A. J. Watkins. Pp. 107; figs. Edward Arnold (Publishers), Ltd., 41, Maddox Street, London, W.1. Price 6s 6d.

This book of examples co-ordinating the technology and calculations of the Course B syllabus is intended for use by students in the second and third years of the City and Guilds Course.

RESEARCH ON WINDING WIRES

NEW LEWCOS LABORATORY AT LEYTON

LAST week we had the opportunity of inspecting the recently inaugurated Wildy Laboratory of the London Electric Wire Co. & Smiths, Ltd., at Leyton. This building makes available a further 12,000 sq ft of working space for the development of wire coverings and wire-covering plant, and is an indication of the company's intention to maintain its claim to be the foremost and largest manufacturing unit of its type in Europe. The Leyton works has a manufacturing capacity of 300 tons of enamelled wire per week. The London Electric Wire Co. was formed in 1879 and incorporated Fredk. Smith, Ltd., in 1909.

It is appropriate that the new laboratory should bear the name it does, for Mr. Wildy, as technical director, established the first technical department at Leyton, and his wife at that time was chief chemist. It was Mrs. Wildy who officiated at the recent opening ceremony.

The Wildy Laboratory of the London Electric Wire Co. & Smiths, Ltd.

Enamels and Varnishes

The top floor of the new laboratory accommodates Mr. J. R. Cox, technical director of the group, Mr. A. J. Taylor, chief technical engineer, and the chemical and electrical research laboratories. The chemical laboratory is equipped for the formulation of enamels and varnishes in glass or stainless steel ware. It has for many years been the policy of the company to manufacture the enamels used in the production of enamelled wire, and in addition to original and development work, the laboratory is responsible for the " tailoring " of current enamels to suit the operating characteristics of production and experimental machines. This policy results in the closest possible control over production quality. The electrical research laboratory is concerned with the development of test methods and evaluation procedures which will ensure that existing and newly-developed coverings will meet the changing and progressively onerous requirements of the electrical industry.

The first floor contains a drawing office and another laboratory which deals with the evaluation of coverings now in the development stage. The drawing office is engaged in the design and development of all types of wire-covering and enamelling plant in accordance with the company's policy of marrying plant and raw materials to ensure optimum quality and control. On the ground floor is a laboratory for the building and pilot operation of novel enamelling machines and other wire-covering plant and areas required for special work are partitioned off under controlled conditions.

The building was designed for the specific purpose of integrating the design and development of plant, products and test methods. It is essentially a research laboratory, with no responsibilities for routine testing and evaluations. There are other laboratories at Leyton where, under technical control, quality and processes are continually watched.

One of the research laboratories at Leyton

VIEWS on the NEWS

By REFLECTOR

IN spite of the provision of the 1957 Electricity Act which seeks to curb the practice of some landlords of residential premises from retailing electricity to their tenants at exorbitant rates this "racket" still goes on. The *Sunday Post* (Glasgow) reports a somewhat blatant case of the kind. A family rented a house at a Clyde coast resort. The electrical equipment appears to have consisted of one boiling ring on which the cooking and water heating had to be carried out. The supply was through a slot meter and the family soon discovered that it was costing them eight shillings a day. Upon inquiry they found that the meter had been adjusted to take account of the landlady's hire-purchase commitments. The Electricity Board was called in and the meter was readjusted. Later when the meter was read the tenants received a rebate, but upon leaving the house were requested by the landlady's solicitors to hand it over. The newspaper says that the Board regretted that it could do nothing about it. Apparently this case is not the only one of its kind; complaints have been received from other holiday-makers in the area.

* * *

There is no doubt that electricity has for some years been the agent of a new industrial revolution. It was the ready availability of coal in the Midlands and North which made those areas the centre of industrial activity and devastated large tracts of formerly beautiful country. Now electricity makes it possible to place industry practically anywhere and although its critics are much concerned with the spread of overhead lines they have to admit that these are doing far less damage to people and places than the smoking factory chimneys which characterised the first industrial revolution. It is now possible for a Brighton newspaper to say:—

> "Sussex is a very lucky county: industry delayed its advent into the county until it could start off with electricity and the countryside remains clean and fresh."

This statement is not strictly true in one particular: Sussex had a flourishing iron industry for quite a long time before the advent of electricity—to the detriment of the forests in the area which supplied the fuel.

* * *

In New Zealand it is illegal for anybody except registered electricians to carry out wiring jobs—even the connection of a domestic plug. *Private Lines* (the journal of the Electricity Supply Authorities' Association of New Zealand) says that the next conference of the Association is likely to have before it a proposal that the regulations should be relaxed so that householders may legally do minor wiring jobs themselves and that the electricity supply authorities should give proper instruction in how to do them. Among the comments on the suggestion which the journal publishes is one to the effect that the electrical industry spends very little on teaching the public how to use electricity wisely. "The trade was reluctant to educate people yet they did not want to maintain home electrical appliances as it was not good business." Although I am very doubtful about electrical "Do It Yourself," I cannot imagine how the New Zealand regulations can be effective. They seem to go too far (but how to limit them I wouldn't care to say) and detection of infringements in the home must be extremely difficult.

* * *

My notes of 28th August included a reference to an "Electricity in Your Home" booklet in which a companion gas publication was stated to have been "prepared with the Electrical Development Association." I have now had a letter from the publishers (Educational Productions, Ltd.) in which they admit that this was a "howler" and say that the booklet was, in fact, produced in collaboration with the Gas Council.

* * *

Under the rather disconcerting title "New Organ for the Non-Musician," a pamphlet which has come into my hands gives particulars of a portable instrument designed for people who cannot read and play music. It is said to be electrically operated and to produce "deep, vibrant and rich tones by utilising controlled forced air, blown through reeds." The keys and chords are denoted by letters and numbers and books printed with special notation are available with the organ. I am not sure that I would appreciate exercises on this instrument by non-musicians, however electrical its operation, but at least it cannot be worse than that other electrically-worked American device, the juke box.

* * *

Recently a system was introduced for recording telephone messages during subscribers' absence, but this could have been done seventy years ago if an American invention had caught on. The *Electrical Review* of 27th September, 1889, contained the following note:—

> "The 'Telegraphophone.' — This instrument has recently been devised by a Mr. Wheless, of Nashville, America. In this instrument the graphophone records are made to actuate a telephonic transmitter, which in turn actuates a receiver, which records on a graphophone at the receiving end of the line the words spoken into the graphophone transmitter. The general idea, it is, perhaps, needless to say, is by no means new, though no doubt Mr. Wheless's method of carrying it out possesses points of mechanical novelty. The invention has for its object the overcoming of what is stated to be a 'serious' defect in the ordinary telephonic system, viz. that if a subscriber is called and there is no response, the caller must wait for another opportunity to communicate; this 'serious' defect, the system of having a permanent record is to overcome."

The *Review* regarded the invention rather coldly, mainly because of possible misuse including "the temptation to record a volley of abusive language for the delectation of the hearer who would be expecting an important communication."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. P. J. Field, formerly chief assistant public relations officer of the Central Electricity Generating Board, has been appointed public relations officer of the Board in succession to **Mr. L. J. Luffingham,** A.M.I.E.E., who, on reaching retiring age, leaves the Board's service.

Mr. Field has had thirty years' journalistic and publicity experience, beginning his press relations work with the Canadian Government in London in 1929. After serving in Fleet Street as reporter and sub-editor he helped to form a public relations organisation which was responsible for public relations and press liaison work in Britain for various Dominion and Colonial Governments and other large organisations. After serving with the R.A.F. and R.C.A.F. during the war he went to the *Daily Telegraph* as a sub-editor. Three years later he became assistant press officer of the

Mr. P. J. Field

Mr. L. J. Luffingham

British Electricity Authority. He was subsequently appointed press officer and, with the reorganisation of the electricity supply industry, became chief assistant public relations officer of the Generating Board.

Mr. Luffingham has been public relations officer of the Board and the former British (Central) Electricity Authority for the past eleven years. Before that he was editor of the *Electrical Times*.

The Central Electricity Generating Board announces that **Mr. S. S. Scott,** O.B.E., M.A., its chief personnel officer since the formation of the Board, is vacating that appointment at the end of this month and is to be succeeded by **Mr. H. C. Spear,** formerly chief personnel officer to the British Overseas Airways Corporation. Mr. Scott, who has continued in the Board's service beyond his normal date of retirement, will, however, continue for some months as an adviser on labour relations matters.

We are informed that **Mr. H. G. Frampton,** D.I.C., M.I.E.E., who retired from the Central Electricity Authority at the end of 1957 and went to British Guiana to advise the Labour Department on Factory Inspectorate, has been appointed Controller of Electricity to deal with the problems of load shedding during an acute shortage of serviceable generating plant.

Mr. A. J. Tanner has been appointed general manager for Electra (B'ham 1935), Ltd. From 1952 to 1959 he was a lighting engineer in the Midland Region of the A.E.I. Lamp & Lighting Co., Ltd., having served during that period with the Edison Swan Electric Co., Ltd., the British Thomson-Houston Co., Ltd., and the A.E.I. Lamp & Lighting Co., Ltd. After war service in the Royal Engineers, he took up the appointment of contracts manager with the British General Electric Co., Ltd., in Hong Kong. Before the war he was with Troughton & Young, Ltd., for nearly twenty years.

Mr. F. J. Jervis, B.Sc.(Eng.), A.M.Brit.I.R.E., A.M.I.W.M., has been appointed contracts manager of Nash & Thompson, Ltd. Mr. Jervis, who is responsible for all commercial aspects of research, development and manufacturing contract work, joined the company from the Guided Weapons Department of the Ministry of Supply where, since 1951, he had been a production engineer.

Mr. D. L. T. Oppé, a director of Morphy-Richards, Ltd., has been appointed a member of the British Transport Commission's Southern Area Board.

Mr. W. J. Jones, M.Sc., M.I.E.E., has been appointed director of the British Lighting Council as from 1st October. He will continue as director of the Electric Lamp Industry Council, a position which he has held since its formation, but as the time he will be able to devote to that office in

Mr. W. J. Jones

Mr. E. I. Counter

future will be limited, **Mr. E. J. Counter,** M.C., has been appointed deputy director of E.L.I.C. from 1st October. Mr. Counter has been secretary of E.L.I.C. since its formation and was previously commercial officer with E.L.M.A.

Mr. I. McKerrow, B.Sc.(Eng.), M.I.E.E., A.M.I.Mech.E., contract electrical engineer with Babcock & Wilcox, Ltd., since 1946, has now been appointed senior electrical engineer in the company's Atomic Energy Department. As contract electrical engineer he was responsible for all electrical work associated with conventional boiler plant projects and contracts. In his new post he will be in charge of all electrical work in the Atomic Energy Department on nuclear plant projects and contracts. He will also be available for consultation on electrical engineering matters to all the company's departments at home and abroad. Before joining Babcock & Wilcox, Mr. McKerrow held various appointments at the Trafford Park Works of the Metropolitan-Vickers Electrical Co., Ltd.

On 9th September at Lancaster House, St. James's, London, **Lord Mills,** Minister of Power, on behalf of

Mr. C. R. King (centre, seated), chairman of the Electricity Council, with recipients of the British Empire Medal. In the back row (left to right) are Messrs. N. G. Andrews, J. H. Lowther, W. H. Jose and V. J. Adsett, and seated with Mr. King are Mr. G. Miles and Mr. J. Gibson

Her Majesty the Queen, presented the British Empire Medal to a number of representatives of the electricity supply industry. Following the presentation, **Mr. C. R. King,** chairman of the Electricity Council, entertained the recipients, their wives and friends at Winsley Street, London.

The following have been elected directors of B.H.D. Engineers, Ltd.:— **Mr. P. Rushworth,** director and secretary of W. C. Holmes & Co., Ltd., **Mr. A. J. M. Henshaw,** director and general sales manager of W. C. Holmes & Co., Ltd., and **Mr. P. Croset,** managing director of the Holset Engineering Co., Ltd.

Mr. T. Pritchard, of H. J. Cash & Co., Ltd., has just returned from a visit to the Swedish head office and factory of Centrum Electronics, Ltd. This is a preliminary to the marketing and installation of Centrum systems in this country by H. J. Cash & Co. in association with Centrum Electronics, Ltd., of Southall, Middx.

Mr. F. Boysen, Associate I.E.E., chief testing engineer of the Eastern Electricity Board, is to join the Simplex Electric Co., Ltd., on 1st October as chief testing engineer. His duties will include the establishment of a laboratory for testing to British and overseas specifications all types of domestic appliances.

Mr. F. Boysen

Mr. Boysen joined the Northmet Power Co. in 1931 at the New Southgate meter testing laboratories. In the immediate post-war years the appliance side of the laboratories' work rapidly outgrew the available facilities and he moved to a temporary test department at Kingsbury, working with the late Mr. R. Grierson. Early in 1948 he was appointed testing engineer, in charge of the newly built apparatus testing house at Wood Green which, on nationalisation, became the Eastern Electricity Board's area testing house. Before joining the Northmet Co. Mr. Boysen was engaged in test work on instruments and other equipment with the General Electric Co., Ltd., and Everett Edgcumbe & Co., Ltd. He has served as representative of the Area Boards on a number of British Standard Committees and on several E.D.A. Technical Panels.

Mr. S. E. Goodall, President of the Institution of Electrical Engineers and director and chief engineer of W. T. Henley's Telegraph Works Co., Ltd., paid an official visit to East Africa towards the end of August. He was accompanied by Mrs. Goodall, Mr. W. K. Brasher (secretary of the I.E.E.) and Mrs. Brasher. They were met in Uganda by Mr. J. M. Stock, O.B.E., and Mr. L. Fergusson, chief electrical engineer and deputy chief engineer, respectively, of the Uganda Electricity Board, and attended an informal dinner given by the Uganda Division of the East African Institution of Electrical Engineers. The party visited the Murchison Falls, where the Nile falls 130ft over a narrow cleft, and downstream from which the Uganda Electricity Board is planning to build a small hydro-electric station. At a sundowner given by the East African Institution of Engineers, Mr. Goodall and Mr. Brasher were introduced to members of that Institution and also of the Institution of Electrical Engineers. The party also visited the Owen Falls hydro-electric station. Other centres visited included Kenya, Rhodesia and South Africa.

Mr. S. E. Goodall with Mr. J. M. Stock, O.B.E., on the turbine gallery of the Owen Falls power station during his recent visit to Uganda. In the background are Mr. Crew-Gee (acting generation engineer of the Uganda Electricity Board), Mr. L. Fergusson and Mr. W. K. Brasher

Mr. G. J. Lyons has been appointed secretary of the Institution of Plant Engineers in succession to **Mr. R. F. Farmer,** who has resigned to take up an appointment with the Institution of Civil Engineers.

Mr. D. N. Ward has been appointed domestic appliance area manager for the English Electric Co., Ltd., in the Eastern Electricity Board area. He first joined the company in 1955 and spent the next two years attached to the domestic appliance division. In 1957 he was given a roving commission with the division's sales staff, after which he joined the Manchester office as a sales representative for the North Western Electricity Board area. In his new post, Mr. Ward will be based on the division's London office at 28, Kingsway, W.C.2. **Mr. C. Wood** will take over Mr. Ward's territory in the North Western area and will be based on the company's Manchester office.

Mr. D. N. Ward

Mr. J. E. Clark, M.I.E.E., has succeeded **Mr. D. C. Birkinshaw,** M.B.E., M.A., as chairman of the Television Society. Mr. Clark is managing director of Cathodeon Electronic, Ltd., a member of the Pye Group.

Mr. H. W. Hoover, Jun., grandson of the founder of Hoover, Ltd., chairman of Hoover, Ltd., Great Britain, and president and chairman of the Hoover Co. of America, is on a visit to this country. He is to discuss with Mr. S. Roberts, the British company's managing director, further developments in the British business, and he will also visit the Continent before returning to the United States.

Mr. H. W. Hoover

Mr. E. J. Sherwood, chief lighting engineer, Simplex Electric Co., Ltd., will be attending the American I.E.S. National Technical Conference in San Francisco. He will return eastwards through the industrial areas, studying American design trends and production methods.

The North Western Branch of the **Electrical Trades' Commercial Travellers' Association** held a general meeting on 14th September at the Sefton Hotel, Corporation Street, Manchester. Mr. L. S. Hargreaves, vice-president, and Mr. R. H. Corlett, national chair-

man elect, attended and following the meeting a talk was given by Mr. A. Griffiths on "Electric Floor Warming." The branch annual luncheon will be held on Thursday, 15th October, at the Lancashire Cricket Club Pavilion, Old Trafford.

Two changes are announced in the publicity organisation of the General Electric Co., Ltd. **Mr. V. G. Burchill** becomes an assistant publicity manager and **Mr. R. Herbert** has been appointed chief press officer.

Educated at Wrekin College and St. Catherine's Society, Oxford, Mr. Burchill is thirty-four years old. He was with Associated Iliffe Press from 1950 to 1953, when he joined the

Mr. V. G. Burchill

Mr. R. Herbert

G.E.C. press office. After two years he went to the Butter Information Council as executive officer and rejoined the G.E.C. Publicity Department in 1957.

Mr. Herbert joined the press office at the Department of Scientific and Industrial Research after demobilisation in 1946. In 1957 he moved to the United Kingdom Atomic Energy Authority's press office and joined the G.E.C. in April this year.

The Simplex Electric Co., Ltd., announces that following the resignation of **Mr. D. S. Panisset, Mr. G. E. Brandon** has been appointed manager of the Creda Development Centre at Alperton. Mr. Brandon previously held the appointment of chief designer at the Centre.

Mr. S. Fryer, a senior member of the staff of T. Clarke & Co., Ltd., has been elected a technical director of the company.

Mr. G. Barnard, A.M.I.E.E., who retired from the National Boiler & General Insurance Co., Ltd., early this year, has joined Norris Consultants, Ltd., of Bristol and London, as manager for the Manchester and North Midlands Area and for the time being will operate from 23, Park Road, Sale.

Mr. G. Barnard

Mr. I. H. Hedley, of the Hackbridge & Hewittic Electric Co., Ltd., and director of its Indian associate, Hackbridge-Hewittic & Easun (Private), Ltd., left England for Madras last week and will be away for about six months. The Madras factory has been engaged since 1956 in the supply and manufacture of transformers in capacities up to 750 kVA, and extensions now in progress will enable greater production to be achieved and permit manufacture of medium and large power transformers.

In view of the continued ill-health of **Mr. N. R. Law,** branch manager of Philips Electrical, Ltd., Nottingham, the need has arisen to appoint a senior colleague to take over the day-to-day running of the branch. **Mr. A. B. Skevington,** at present area manager, Electrical Appliances Division, is appointed to this new position. He joined Philips at Nottingham in 1949 as a lighting division representative and was promoted lighting sales supervisor in 1955. Two years later he took up his present post. **Mr. R. Seers** is appointed area manager, Electrical Appliances Division, in succession to Mr. Skevington. Joining the head office of Philips in 1940, Mr. Seers worked in the Radio Sales Department until 1951 when he became TV and Radio Division representative for the East Midlands. Mr. Seers' territory will be taken over by **Mr. E. W. Clarke,** who since 1955 has been Lighting Division representative in Nottingham. During the past four years he has operated mostly in North Nottinghamshire and North Derbyshire.

Mr. N. J. Day, M.A., G.I.Mech.E., who writes in this issue (page 323) on "Applications of Electronics to Industrial Instrumentation," received his technical education at Enfield Technical College and he obtained his degree at Cambridge University. He has held the positions of technical officer for the Institution of Production Engineers and assistant secretary to the Scientific Instrument Manufacturers' Association. At present Mr. Day is sales promotion officer and technical writer for W. G. Pye & Co., Ltd.

Mr. N. J. Day

Mr. David Williams, B.A.(Hons.), warden and tutor at the residential training establishment of the Electricity Council at Horsley Towers, Surrey, has been appointed deputy education and training officer to the Council. Mr. Williams, who has been at the training establishment for four years, was previously organising tutor in adult education for South West Lancashire and tutor in economic history and industrial relations for extra-mural courses organised by the University of Manchester. During the war he qualified as a staff officer at the School of Military Intelligence, and was demobilised with the rank of major. Before the war Mr. Williams held teaching appointments in North West England.

The British Central Electrical Co., Ltd., announces that **Mr. F. G. T. Howard** has joined the staff as personal assistant to the managing director. Mr. Howard spent seven years with Enfield Cables, Ltd. During the war he served in the Navy, spending much of his time on active service overseas.

Mr. F. G. T. Howard

Mr. K. Stephen has been appointed sales manager of the Lindley Thompson Transformer & Service Co., Ltd.; he has been associated with the company in a sales capacity since 1951.

The annual dinner of the **I.E.E. Mersey and North Wales Centre** will be held on 2nd November (6.30 for 7 p.m.) at the Grosvenor Hotel, Eastgate Street, Chester.

Mr. G. E. Hart has been appointed technical sales director of Chamberlain Industries, Ltd. He has been with the company for nearly twenty-five years.

Mr. L. Grainger has been appointed manager of the Ilford branch of Belco London, Ltd.

OBITUARY

Mr. Roland Gregory, formerly sales engineer on the outside sales staff of the Birmingham and District office of George Ellison, Ltd., died on 14th September at the age of eighty-one. Mr. Gregory joined the company in 1911 and retired in 1954 after forty-three years' service with the company.

Mr. Albert P. Curtis, a director and general sales manager of the British General Electric Co., Pty., Ltd., died recently in Sydney at the age of fifty-seven.

Mr. D. M. Mason.—The death occurred on 21st September of Mr. David Meredith Mason, A.M.I.E.E., managing director of the Standard Wholesale Electrical Co., Ltd., Croydon.

WILLS

Mr. T. G. A. Bloomfield, a director of Batwin Electric Motors, Ltd., who died on 3rd May last, left £25,025 gross (£23,903 net).

Mr. S. A. Harrowell, joint managing director of the Progress Cables & Accessories Co., Ltd., left £7,176 gross (£6,033 net).

Mr. F. C. Burrough, managing director of Burrough Electrical Co., Ltd., Manchester, who died on 3rd December last, left £12,958 gross (£11,311 net).

Lt.-Col. C. H. Brazel, C.M.G., M.C., M.I.E.E., chief engineer and manager, Government Electrical Undertakings, Ceylon, 1934-48, who died on 26th April last, left estate in Great Britain valued at £1,105 gross (£1,035 net).

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Church Heating by Infra-Red Radiation

THE letter by Mr. S. D. Dinenage (18th September issue) is most interesting and, of course, I quite agree that it is an obvious advantage to maintain a constant fabric temperature.

In addition to infra-red radiation, my company specialise in thermal storage heating both in our warm floor and Thermodare storage systems. We do recommend, wherever possible, the use of a combined scheme providing a background temperature plus boost heating with infra-red radiation and indeed there are many such schemes installed. Unfortunately, there are many instances where the cost of additional background temperature cannot be met by the Church Council concerned. The use of infra-red radiation only, offers an economic and efficient system within the means of the Church. Undoubtedly, when electricity can be offered even more competitively we shall see more churches using the combined system.

With regard to the maintenance of infra-red heaters, it is, of course, important to maintain the reflector and the silica quartz in a clean condition and this will vary from place to place dependent upon the cleanliness of the atmosphere. In the majority of instances, as far as churches are concerned, cleaning at the start of a heating season is normally sufficient. In some instances, however, it may be necessary for additional cleaning to be carried out half-way through the season. The method of cleaning as far as Thermodare heaters are concerned is to use a pad soaked in methylated spirits, which should be used on the reflector and the silica quartz tube.

Apart from laboratory experiments we have been able to examine units that have been in use in the region of 2,000 hours. The fall-off in distribution efficiency and any movement of the peak-radiated energy has been negligible. The element wire is not subject to oxidisation and therefore there is very little build-up of impurities on the inner surface of the quartz tube. The units concerned were maintained in accordance with recommended instructions.

London, S.W.1. R. J. FRANCIS,
Thermodare (Great Britain).

BIRMINGHAM UNIVERSITY "OPEN DAYS"

LAST week the Electrical Engineering Department of Birmingham University held two "open days" in its recently completed new building to give those interested an opportunity of inspecting the premises and seeing something of the work which is being conducted in the various laboratories.

For over 50 years the Electrical Engineering Department was accommodated in a wing of the main university building at Edgbaston. It was moved to its present building just two years ago, well before building operations were completed. The Department occupies one half of the new building, which has been constructed at a cost of well over £500,000, the other half being occupied by the Department of Mechanical Engineering.

This year the Department is taking in 60 undergraduates compared with 50 in previous years. In addition, there will be 40 graduate students, 25 of whom will be research students, and 14 will be on graduate courses working for an M.Sc. degree.

The Department now has at its disposal some 56,000 sq ft of floor area which includes about 20 laboratories of varying size and, under Professor D. G. Tucker, D.Sc., head of the Department, there is a teaching staff of 15. There are also four research fellows and 16 laboratory technicians. The policy of the Department is to admit students from overseas at the rate of about one in ten to undergraduate courses and one in three to post-graduate courses.

During the open days we saw a number of interesting projects in the laboratories. For instance, in the circuit laboratory there was a demonstration of power control by means of triode transistors. In the materials laboratory the formative mechanisms of intrinsic breakdown in liquids are being studied using Schlieren optical techniques and spark photography. The relatively slow growth of pre-breakdown phenomena from the cathode into the inter-electrode space has been observed, leading to a complete breakdown of the liquid at sufficiently high applied voltages. In the same laboratory a new type of space heater is being developed using the high dielectric losses of ceramic ferro-electric materials at power frequencies.

In another laboratory a new class of solid state devices is being developed and in connection with this work space-charge-limited current flow through insulating crystals has been achieved. These include a dielectric diode and dielectric triode which should be relatively insensitive to temperature changes and have usable frequency ranges exceeding those of either thermionic valves or transistors.

The magnetic field of the end windings of an alternator causes eddy-current losses in the core end plates of the machine and it also causes the mechanical forces which tend to distort the windings under short-circuit conditions. Both of these factors are becoming increasingly important in modern highly rated machines. An investigation has begun in the machines laboratory into the nature of the end-winding field distribution with the object of predicting the intensity of the magnetic field and the magnitudes of the forces acting on the windings.

Australian Imports

Australia's import ceiling has been raised by £50 million to £850 million a year and licensing discrimination against nearly all dollar imports has been removed. More than 90 per cent of the range of Australian imports can now be bought from any country, but domestic electrical appliances will still be subject to licensing. It is pointed out, however, that for such goods the importer will be permitted to import from dollar sources up to £5,000 of his total quota.

INDUSTRIAL NEWS

Cable Testing Equipment for America

An order exceeding $250,000 has been placed with Ferranti, Ltd., by the Anaconda Wire & Cable Co., of Hastings-on-Hudson, New York, for what is believed to be the largest high-voltage a.c. cable testing set yet built by a British manufacturer. The order covers the supply of a 14,000 kVA, 250 kV a.c. cable testing set capable of supplying 55 A for approximately two hours. A second transformer unit is also included which, when connected in cascade, will give an output of 500 kV at 6 A continuously. The equipment will be designed for controlled series resonant operation for both 250 and 500 kV by means of continuously variable moving coil reactors. Two step-up transformers, one feeder transformer, two moving coil reactors and control desk comprise the complete equipment.

Electrolytic Tinning Plant

The Head Wrightson Machine Co., Ltd., a subsidiary of Head Wrightson & Co., Ltd., has been awarded contracts for plant valued at over £2 million for the installation of an electrolytic tinning line at the Ebbw Vale Works of Richard Thomas & Baldwins, Ltd., capable of tinning and re-coiling 1,500ft of steel strip per minute. The line will be built at Head Wrightson's works on Tees-side. Additionally, equipment is being supplied for the preparation of steel strip before it is processed in the tinning line, for tin plate cut-up lines and for equipment to inspect and assort the plate. Delivery will be made in eighteen months and it is being designed in collaboration with the Aetna Standard Division of the Blaw Knox Company of America, with whom the Head Wrightson Machine Co., Ltd., has been associated for several years.

Diesel Generators for Pakistan

An order valued at over £500,000 for the supply of diesel generating equipment to the Karachi Electricity Supply Corporation has been awarded to the English Electric Co., Ltd. When installed, the eleven diesel generating sets will supply power to a total of 15,000 kW for the industrial area of Karachi. The engines, of the supercharged dual-fuel type, will run on natural gas from the large Sui gas field in West Pakistan. The first part of the equipment will go into service in the middle of 1960, and the station will be fully operational towards the end of that year. Besides diesel engines and alternators, the contract includes switchgear, transformers and station auxiliary equipment. The 8-cylinder diesel engines will be made at the company's Rugby works, the alternators at Stafford, the switchgear and the 500 kVA station transformers at Liverpool. The engines are of the SRLD type operating at 428 r.p.m. and the alternators each have an output of 1,364 kW.

Government to Dispose of Rubber

Last week the Board of Trade announced that its entire stock of rubber, about 100,000 tons, is to be disposed of. The release of the rubber will be spread over a number of years to avoid disruption of the market.

Volta River Scheme

Earlier this year the Ghana Government signed a contract with the American Kaiser concern by which the latter was to proceed with work preliminary to the Volta River hydro-electric scheme, including the construction of roads and living accommodation for workers on the site. It was announced in Accra last week that Mr. Edgar Kaiser was in the capital to discuss the possibility of establishing aluminium works upon which the success of the project will depend. The proposal is that Mr. Kaiser shall take active steps to form a consortium of aluminium producers for the purpose of erecting a smelter at Tema, the new port.

Bulawayo Tyre Plant

The new Bulawayo factory of Dunlop Rhodesia, Ltd., was opened recently by the Prime Minister of the Federation of Rhodesia and Nyasaland, Sir Roy Welensky. The overall responsibility for the design, manufacture and installation of the complete electrical equipment for this new factory was placed with the Electric Construction Co., Ltd., Wolverhampton, and their South African associates, Hubert Davies & Co., Ltd., Johannesburg.

The contract included 11 kV switchgear, outdoor transformers, low voltage switchgear, automatic power factor correction equipment and numerous motors and auxiliary equipment within the factory proper. The largest motor is rated at 500 h.p., 730 r.p.m., and drives a Banbury mixer.

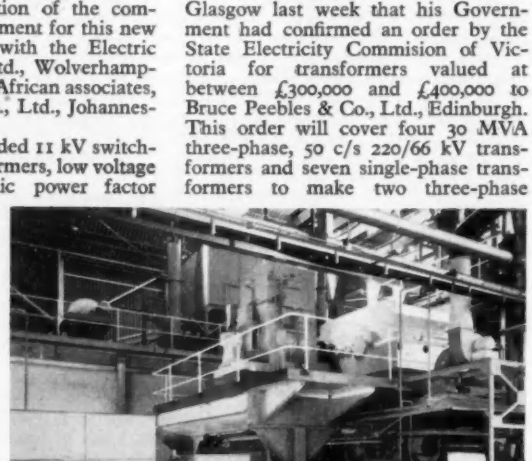
The contract also included three Ward-Leonard sets, each supplied by a separate feeder from the substation. The set for the tread line consists of a 217 h.p. motor driving two generators and an exciter on a common bedplate. One generator feeds the 125 h.p. extruder motor, the speed of which is varied by push-button control of the generator field regulator. The second generator is similarly controlled and feeds the three take-off conveyor motors of the two calenders.

Statter Switchgear Exhibitions

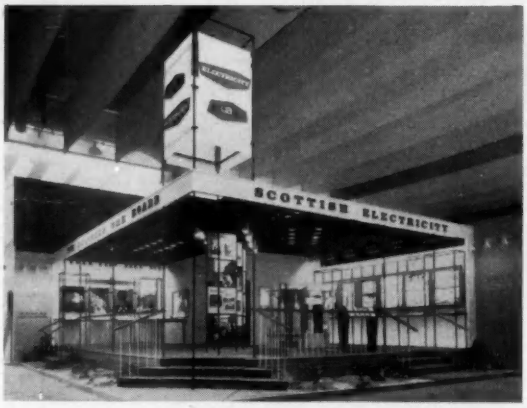
In order to give an opportunity to electrical engineers in various parts of the country to inspect the new designs of their h.v. metalclad switchgear, J. G. Statter & Co., Ltd., are holding a series of local exhibitions. The first exhibition will be held at the Birmingham Engineering Centre, Stephenson Place, Birmingham, 2, from 29th September to 1st October (10 a.m. to 6 p.m. each day). The switchgear to be exhibited will include oil and air circuit-breaker units, oil fuse switch unit, oil immersed isolator, indoor busbar metering unit and a selection of miscellaneous equipment.

Transformers for Australia

Sir William Leggatt, Agent-General for Victoria, Australia, announced at the Scottish Industries Exhibition in Glasgow last week that his Government had confirmed an order by the State Electricity Commision of Victoria for transformers valued at between £300,000 and £400,000 to Bruce Peebles & Co., Ltd., Edinburgh. This order will cover four 30 MVA three-phase, 50 c/s 220/66 kV transformers and seven single-phase transformers to make two three-phase



The Banbury mixer in the Dunlop Bulawayo factory. The 33 kV circuit-breaker and the rotor starter for the 500 h.p. driving motor are shown in the centre while the air-circuit water-cooled motor can be seen on the platform immediately above. A 3·3 kV automatic starter for a 350 h.p. mill motor is seen on the left-hand side



The stand which was jointly shared by the South of Scotland Electricity Board, the North of Scotland Hydro-Electric Board, and the Scottish Gas Board at the Scottish Industries Exhibition, Glasgow

banks rated at 45 MVA 220/22 kV with a spare single-phase unit. They will be used in the power distribution system of Victoria. It is the second large order received by Bruce Peebles from Australia in two years. The first order was for three 90 MVA 275/66/11 kV transformers for the Electricity Trust of South Australia.

Electricity in Housing and Town Planning

Some of the ways in which electricity applied to space heating and water heating provides comfort and convenience in existing homes, and simplifies construction of new homes, will be illustrated on the stand of the Electrical Development Association at the Winter Gardens, Blackpool, at the National Housing and Town Planning Exhibition to be held from 27th to 29th October. One section of the stand will be devoted to the installation of under-floor warming cables, full-size sectional models showing the type of equipment used and the disposition of the heating wires. Enlarged photographs will illustrate typical examples of all-electric floor warmed housing. Another section of the display will stress the advantages of electric water heating.

Order for Electronic Instruments

Avo, Ltd., a company in the Metal Industries Group, has secured an order from the Ministry of Supply for electronic instruments valued at £14,000.

Colliery Year Book

The 37th edition of the "Colliery Year Book and Coal Trades Directory," published by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1 (price 40s net, by post 42s), presents in a convenient and reliable form the fullest information on the coal mining and allied industries. Information on coal production in Western Europe, the U.S.A., Poland and the U.S.S.R. has been shown as fully and accurately as possible. Full particulars of every coal mine in Great Britain are given, together with current information regarding the Ministry of Power and the National Coal Board, and the Mines and Quarries Regulations 1956 and the 1958 amendments. The foreword contributed by Sir James Bowman, K.B.E., chairman of the National Coal Board, refers to the difficulties now confronting the coal industry through the challenge of oil and the rapidly approaching atomic power. This, he points out, is a challenging time and the Year Book is an invaluable work of reference for everyone concerned in the industry.

Production Exhibition

The next Production Exhibition, the fourth in the series, will be held in the National Hall, Olympia, London, from 25th to 30th April, 1960. Intending exhibitors should write for details to the Production Exhibition, 11, Manchester Square, London, W.1 (telephone: Hunter 1951).

Cable-Making Machinery Orders

Fawcett Preston, the Metal Industries Group's engineering subsidiary, of Bromborough, Cheshire, has secured orders valued at nearly £30,000 for cable-making machinery for Finska Kabelfabriken Aktiebolag, Batsmansgatan, Helsinki, Finland (£15,665), and Nordiske Kabel- og Traadfabriker Aktieselskabet, Copenhagen, Denmark (£13,745).

Switchgear Demonstration Van

A nation-wide tour commenced in Newcastle on Monday last of a demonstration van containing switchgear built at the Liverpool works of the English Electric Co., Ltd. Demonstrations of new medium and high voltage switchgear are being given to invited industrialists, electrical power and marine engineers by a team of experts headed by Mr. L. J. Lloyd, switchgear sales manager at Liverpool. The main areas of the first tour, which lasts over three months, are Tyneside, Scotland, Teeside, Bristol and London. The van will be in the London area from 5th to 16th October.

Computers for Smaller Firms

The Central London Productivity Association (affiliated to the British Productivity Council) is holding a one-day conference on Thursday, 22nd October, entitled "Computers for the Smaller Firm." The conference is designed to introduce the smaller firm to the potentials offered by computers; to illustrate the use of the smaller computers; the progressive utilisation of computers; service centres and joint ownership. Speakers from three leading computer manufacturers will be illustrating their papers with slides and case histories. The conference fee will be 45s (members of the Association 35s) and will include coffee, luncheon and tea. Programmes and tickets may be obtained from Mr. D. MacGlashan, Central London Productivity Association, c/o Stafford Allen & Sons, Ltd., 20-42, Wharf Road, London, N.1.

Demineralisation Plants for Mexico

William Boby & Co., Ltd., water treatment engineers, Rickmansworth, Herts, are supplying two complete demineralisation plants for Mexican power stations. One is for installation at a new power station in Oaxaca, being built by Associated Electrical Industries Export, Ltd., for the Comision Federal de Electricidad Juchitan. Boby's are also supplying acid dosing plant for condenser cooling water. The second similar set of equipment is for another of the authority's stations, as yet unnamed.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £225 10s 0d
Fire Refined 99·70%	ton £224 0s 0d
Fire Refined 99·50%	ton £223 0s 0d
COPPER Tubes ..	lb 2s 2d
Sheet	ton £256 0s 0d
H.C. wire and strip ..	ton £275 15s 0d
LEAD, English ..	ton £70 5s 0d
Foreign	ton £69 0s 0d
MERCURY	flask £71 10s 0d
TIN, block (English) ..	ton £792 10s 0d
ZINC, G.O.B. Foreign	ton £85 10s 0d
BRASS Tubes (solid drawn)	lb 1s 9¾d
Wire	lb 2s 7¾d
PHOSPHOR BRONZE Wire	lb 4s 0d
PLATINUM ..	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 33½d—34d

Lighting in the Home

An exhibition which offers suggestions for improvements in "Lighting Your Home" is now in progress at the Design Centre, 28, Haymarket, London, S.W.1, and will continue until 7th November. The exhibition has been arranged in association with the Illuminating Engineering Society which has provided technical advice on its planning and on the information panels which accompany the display. Special attention is drawn to three main points. These are adequate general lighting, the use of local lighting for special activities, and avoidance of glare. Apart from a selective display of the growing number of good modern lighting fittings on

the market, including ceiling flush fittings and pendants, wall lights, table lamps and floor standards, and fluorescent fittings, the correct placing of light outlets in a room are illustrated in two settings showing a dining-living room and a bed-sitting room.

Price Reductions

Further price cuts are announced by Atlas Lighting, Ltd. As from Monday last the prices of all reflector type fittings (both metal and "Perspex") in the Atlas "Atlantic" range of fluorescent fittings have been reduced. The price of the basic Series 1 "Atlantic" chassis unit is not affected.

Contract Price Formulæ

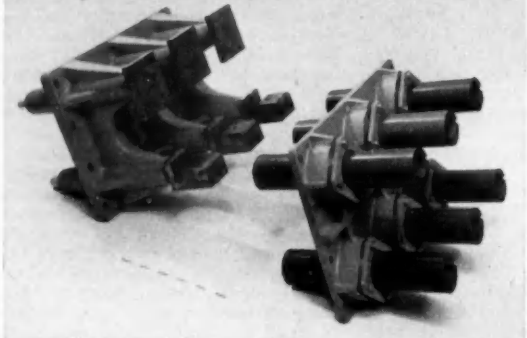
The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 18th September is deemed to be 196s. The "costs of materials" figures are: For electrical machinery and equipment the Board of Trade index figure published on 18th September is 178·6 (1949=100) and 115·1 (1954=100); both figures are provisional. For turbo-generating and allied plant: Materials used in mechanical engineering industries 186·6 (1949=100) and 124·2 (1954=100); both figures are provisional. Blast furnaces and iron and steel melting and rolling (40 and 41) 188·7 (1949=100) and other steel goods, excluding tubes (311 and 312), 128·6 (1954=100); both figures are provisional. The price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 18th September) is 47½d per lb.

Epoxide Resins for High Voltages

An order for epoxide mouldings worth $72,500 has been received by J. R. Ferguson (Electrical Engineers), Ltd., Dukinfield, Cheshire, from the Federal Pacific Electric Co. of Newark, New Jersey, U.S.A. The Federal Pacific Co. are in association with J. R. Ferguson for the manufacture of epoxide mouldings in the United States, and this order is intended to enable the American company to make an early start on the use of this resin in their air-break switchgear.

The illustration below shows one of the mouldings involved. The original design, seen on the right, comprises an aluminium base plate to which are fitted synthetic resin bonded paper tubes and copper conductors. This is an expensive manufacturing procedure and the epoxide moulding, shown on the left, eliminates all machining and fitting. Another point about the new design is that the impulse level is much improved. The unit described is for 1,200 A, 250 MVA, 5 kV, and weighs 200 lb.

Substitution of aluminium and synthetic resin bonded paper assemblies by an epoxide moulding, eliminating all machining and fitting



E.W.F. Scottish Visit

The annual function of the Scottish Section of the Electrical Wholesalers' Federation is to be held at the Great Western Hotel, Oban, from 29th September to 2nd October. The Council of the Federation will hold a meeting on the morning of 30th September at which it will be joined by the Scottish members. A golf competition has been organised and various other informal relaxations will be available. A dinner will be held on 1st October. On behalf of the Scottish Section invitations have been sent to representatives of leading manufacturing and contracting organisations.

Trailer-Mounted Generating Sets for Argentina

The dispatch of four 500 kW transportable generating sets by the National Gas & Oil Engine Co., Ltd., a member of the Hawker Siddeley Group, completes a series of orders placed by the Argentine Government. All deliveries have been made by this company during a period of seventeen months and total over £1,000,000 in value.

Each of the four trailer sets comprises a National type R4AUU8 turbo-charged, eight cylinder diesel engine directly coupled to a Brush alternator with an output of 500 kW, Brush switchgear, an air compressor set, fuel tank and lubricating oil purifier. These units are mounted on a skid-type underbase. The complete assembly is secured to an independent 16-wheel trailer, built by the British Trailer Co., Ltd.

One of the 500 kW trailer-mounted generating sets supplied by the National Gas & Oil Engine Co. to the Argentine Government

The sets form a "strategic reserve" of power for emergency use in any one of the many hundreds of townships in the interior. Normal power output of these isolated stations ranges from 500 to 3,000 kW.

London Transport Report

In referring to the 1958 report of the London Transport Executive in our issue of 11th September we gave the price incorrectly as 2s. The report, available from 280, Marylebone Road, N.W.1, costs 2s 6d.

Trade Announcements

An extension to the Smethwick (Staffs.) factory of **Hadley Telephone & Sound Systems, Ltd.**, has provided an additional 3,000 sq ft of workshop area and doubled the production capacity of departments engaged on research and the development of special electronic equipment. At the same time, a general reorganisation of factory and plant layout has added to the capacity of other departments.

Kenwell Electric, Ltd., announces that **Nettle Accessories, Ltd.**, Sales Department, Warren Street, Stockport, has undertaken on their behalf the distribution of supplies of Kenwell components.

With effect from 19th October, the address of the Sheffield office of the **E.M.B. Co., Ltd.**, will be 88, Brincliffe Edge Road, Sheffield, 11. The telephone number remains the same (Sheffield 55278).

The London area sales office of the **Northern Aluminium Co., Ltd.**, has removed to 50, Eastbourne Terrace, London, W.2 (telephone: Paddington 3281).

Nash & Thompson, Ltd., have appointed **A. R. Bolton & Co.**, 3a, St. Vincent Street, Edinburgh, 3 (telephone: Caledonian 2065), as their sole agents for Scotland.

Change of Name

H.V.E. (Electric), Ltd., has changed its name to Thermoduct, Ltd.

NEW OIL CIRCUIT-BREAKER

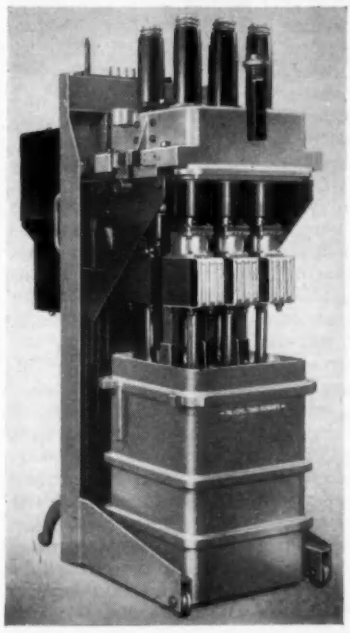
Increased Margin of Safety in J. & P. Design

A NEW oil circuit-breaker, which has achieved a high standard of performance in an exhaustive series of tests recently completed at the K.E.M.A. Laboratories, has been introduced by Johnson & Phillips, Ltd. This type PDB breaker has been designed for use in the company's standard metalclad switchgear, which is of the dimensions and price normally associated with gear having rupturing capacities of 250 MVA at 11 kV, but it has been certified for use at 350 MVA at 11 kV. The additional margin of safety which the breaker offers on normal distribution systems will, therefore, be immediately obvious.

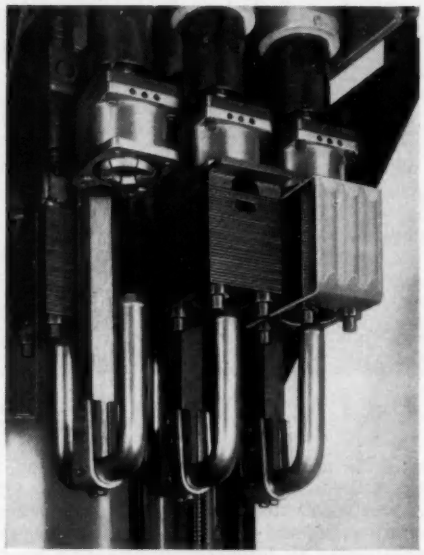
The PDB breaker is a double-break unit with cross-jet arc-control devices of an improved pattern. It is suitable for incorporation into standard J. & P. metalclad vertical isolation draw-out pattern switchgear, with air-insulated or compound-filled busbars, which is only 1ft 9½in in width. The rating capacities for which certificates have been awarded are 350 MVA at 11 kV, 250 MVA at 6·6 kV and 150 MVA at 3·3 kV. To meet certain overseas requirements the breaker has also been tested for 250 MVA at 13·8 kV. The current ratings are 400 A, 800 A and 1,200 A.

The tests were extremely exhaustive and exceeded the requirements of B.S. 116:1952 which, in its present form, only requires the performance of the breaker to be proved for three-phase faults which may or may not be connected to earth. Under system conditions many faults are line to earth and obviously it is desirable to prove the performance under these conditions. Each phase of the PDB breaker was successfully tested to earth separately at full power.

When a circuit-breaker of this type (i.e. three phases in one tank) is clearing a fault on an outside phase only, the internal stresses in the circuit-breaker are asymmetrical—not approximately symmetrical as when clearing a fault in all three phases. If provision is not made in the design to meet these stresses then mechanical jamming can take place, preventing the breaker opening fully. The testing of each phase of the PDB circuit-breaker has proved its ability to withstand these stresses.



Johnson & Phillips type PDB 1,200 A arc-control circuit-breaker



Contact arrangement of type PDB 1,200 A circuit-breaker

One of the features of the breaker revealed in the testing was that at all short-circuit ratings (even down to 2½ per cent of its full rating) the entire arc was confined within the arc-control device. Usually at low ratings the pressures within the arc-control device fail to rise sufficiently to extinguish the arc while the contacts are still within the device. By achieving this performance the control of the arc is much more positive.

Probably the fact of greatest interest to engineers is that a margin of safety greatly in excess of that previously available can now be enjoyed with switchgear of standard dimensions and at a price associated with gear tested at 250 MVA at 11 kV and similar duties. A breaker that has been successfully tested at 350 MVA will remove all fears when employed on a 250 MVA system.

This margin of safety applies for fault current interruption and for making under fault conditions as can be seen from the following minimum requirements specified in B.S. 116:1952.

	250 MVA, 11 kV	350 MVA, 11 kV
Breaking current: Symmetrical	13·1 kA	18·3 kA
Asymmetrical	16·3 kA	22·8 kA
Making current	33·4 kA peak	46·6 kA peak

The 350 MVA, 11 kV breaker has a safety margin 40 per cent greater than a 250 MVA breaker when employed for the lower duty. Although the PDB breaker is designed primarily for the more usual distribution duties of 250 MVA at 6·6 or 11 kV, it will enable J. & P. switchgear to be offered at a competitive price when 350 MVA, 11 kV gear is required.

In the 800 A unit porcelain bushings are used. As

is well known, porcelain bushings are much preferred electrically to bakelised paper bushings, but in order to obtain mechanical strength the latter usually have to be used for higher ratings. The 800 A PDB breaker was successfully tested at 350 MVA, 11 kV with porcelain bushings.

The new type PDB breaker replaces the type TSB circuit-breaker previously employed for higher rupturing capacities in J. & P. metalclad gear. It is of similar dimensions to the TSB breaker with which it is interchangeable. The moving contacts are of solid round copper rod which make into fixed contacts consisting of a circular configuration of finger contacts backed by helical springs. A buffering system is incorporated to cushion the moving contacts when the breaker opens under fault conditions.

Dependent upon the current rating of the breaker, the top plate is of cast aluminium or fabricated steel plate, with non-magnetic inserts between the bushings. The tanks are fabricated from steel plate and the three phases are segregated from each other within the tank by barriers of rectangular formation. The top plate is designed to form a complete housing for the contact lifting mechanism of the breaker, which consists of a simple bell-crank arrangement, and to provide an expansion chamber for cushioning the impulse pressures set up under short-circuit conditions. The toggles necessary to reduce the forces of tripping are contained within the external operating mechanism and not within the breaker.

The terminals are carried in porcelain insulators or synthetic resin bonded paper bushings, cemented solidly into stiffening tubes welded to or cast in the top plate. The terminals can be either of the bolted or plug type, depending on particular requirements, and conversion from one type to the other is simple. Cast epoxy resin bushings can be supplied if required.

Solenoid, power spring, or spring-assisted-manual operating mechanisms are available to suit the various ratings. The power mechanisms are interchangeable and a spring-closing device can be replaced by a solenoid magnet without disturbing the main operating mechanisms. All mechanisms are of the free-handle type, arranged to accommodate overload, shunt and earth leakage trips, and provide very fast opening times under all conditions between no-load and short circuit, together with fast closing speeds.

LONDON TRAFFIC-ROUTE LIGHTING

ALTHOUGH its first task, the examination of street lighting standards on main traffic routes in the Greater London area with a view to issuing recommendations for greater uniformity and continuity, is not yet completed, an interim report has been published by the Consultative Committee on the Lighting of Traffic Routes within the London Conurbation, indicating the lines along which the work is progressing and making certain recommendations. The Committee, which has met five times since its formation in July, 1958, at the suggestion of the Ministry of Transport and Civil Aviation, consists of representatives of local authorities.

The most important matter considered is the need for a minimum standard of light output for traffic routes. There is no measure at present for determining the precise relationship between the amount of light used and its resulting effectiveness. Normally, the light output from an installation is given in terms of the number of lumens provided by the lanterns per 100 linear feet of road and, although used in the report in the absence of any better guide, it is recommended that Government and other research stations should produce a more satisfactory basis for measuring the effectiveness of lighting in terms of visibility to road users. Although various standards may be used for different types of route, depending upon environmental conditions, it is thought that the minimum illumination level laid down in the British Standard Code of Practice (2,600 lumens per 100 linear feet) is too low for modern requirements and a minimum value of 5,000 should be adopted.

No definite preference for one type of light source is expressed at this stage but in the Committee's opinion the 140 W sodium installation at approximately 120ft spacing gives the most uniform glare-free lighting and is generally favoured by motorists. Although there is a general preference for sodium lighting, the Committee does not wish to discourage local authorities from experimenting with new types of fluorescent and colour-corrected mercury installations or with the new high output sodium sources. It is emphasised that there should not be an abrupt change in lighting values between systems. A minimum mounting height of 25ft is recommended, but the spacing between lanterns is considered to be a matter for the lighting engineer of each local authority and is regarded as an example of the fact that many aspects of street lighting cannot be precisely specified. The report recommends that lighting-up time should be approximately sunset in winter and up to 30 minutes after sunset in summer, while extinguishing time should be between 15 minutes before sunrise in winter and 30 minutes before sunrise in summer. The Committee is firmly of the opinion that all lights on traffic routes should remain on for the whole period between these times, but those authorities who wish to have diminished lighting after midnight or 1 a.m. should ensure that the illumination level does not fall below the recommended minimum.

After examining all the present control methods, it is suggested that the solar dial clock should be used as a standard wherever practicable. Recent developments in radio control for street lighting have also been considered, the major difficulty being the allocation of an exclusive frequency.

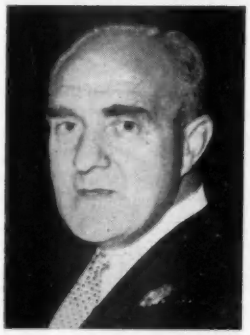
The use of centrally suspended lighting fittings does not generally ensure adequate visibility on the kerbs and footways and tends to induce traffic to keep to the centre of the road, and this method is not favoured except perhaps for narrow roads. The gradation of lighting for approximately 50 yd on side roads adjoining the traffic route, the use of light-coloured road surfaces and the care necessary in the design of installations incorporating cut-off lanterns are also considered. The tendency to reduce the level of street lighting in areas where a measure of illumination is provided by shops is thought to be a dangerous policy, and where parallel service roads are also illuminated the lighting of the traffic route should always be at a higher level. The report concludes with appendices giving, in graphical form, the recommended lighting-up and extinguishing times, showing them in relation to sunset, sunrise and the lighting times for road vehicles, and listing the 102 local authorities in the area covered by the Committee.

The Craft of Public Lighting

PROCEEDINGS OF THE 32nd ANNUAL A.P.L.E. CONFERENCE

AT their meetings in Aberdeen last week delegates to the conference of the Association of Public Lighting Engineers were mainly concerned with an examination of the detailed practical aspects of some of their work and of the principles and standards that should be adopted. But in both the official sessions and in informal discussions much attention was given to broader problems of future development, such as the need for securing agreement between adjacent lighting authorities; the lighting of motorways, about which lighting engineers are, surprisingly, far from unanimous; and the desirability of a higher degree of illumination in Group B schemes. In addition to the official exhibition (described in last week's issue) delegates were rewarded for their long journey by the opportunity of studying the many excellent lighting schemes carried out in Aberdeen. In particular, great care has been taken in the central area to preserve the beauty of the streets while providing a high standard of illumination.

To mark the golden jubilee of the Illuminating Engineering Society one session was devoted to a lecture on "Fifty Years of Lighting" by Mr. C. C. Smith, M.I.E.E., president of the Society. As an indication of the progress made in street lighting, Mr. Smith mentioned that the number of street lamps in use in Great Britain now exceeded ten million. In the past ten years, over 5,000 miles of roads had been provided with new or improved street lighting at a cost of about £20 million.



Mr. C. C. Smith

The work of the Government in promoting development was referred to by Mr. R. D. N. Bell of the Scottish Office, who deputised at the annual luncheon for Lord Forbes, Minister of State. He said that some people might say that the two experimental installations sponsored last year by his Department had demonstrated little that was not known or suspected beforehand. But an ounce of demonstration was worth a ton of argument and from the Department's point of view they had enabled the most important question of the lighting to be installed on the Forth road bridge to be settled more quickly.

Craftsmanship Defined

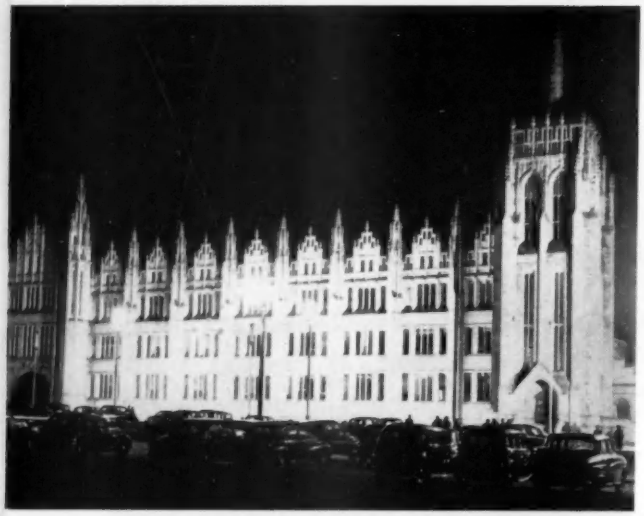
In the first of the technical papers, the title of which ("Craftsmanship in Public Lighting") provided the theme of the conference, Mr. L. C. Rettig, F.I.E.S. (Siemens Edison Swan, Ltd.) outlined the specialist skills required by a public lighting engineer and gave a comprehensive survey of the principles that should guide him in the practice of his craft. This craft Mr. Rettig defined as "Skill in planning schemes for the lighting of all types of public thoroughfares and skill in the selection of the proper equipment to be used." The public lighting craftsman by acquiring a critical faculty towards the latest developments in methods and equipment and towards the results of his own work would become one of those rare people with a sense of vocation.

The new president, Mr. Ronald Parker, being installed in office by the retiring president, Mr. Granville Berry (left) and the conference secretary, Mr. Eric Evans

After briefly describing some measuring instruments that he had developed to help him in his work, Mr. Rettig said that published recommendations on street lighting differed only in minute detail and had been well proved in practical application. They all failed, however, to give sufficient guidance on the question of the "wise compromise" needed for unusual circumstances and also in lack of emphasis on the achievement of high factors of safety. The craftsman was thereby left to establish his own code of practice and this must permit of no compromise that caused his work to be regarded as a contributory factor in an accident. It was mainly an ethical code which while allowing compromise in the numbers of light sources ideally required in complicated schemes, insisted upon the achievement of continuity of road brightness despite any modification of the original positions selected.

In presenting his paper Mr. Rettig made use of an ingenious illuminated diagram to illustrate step by step how he would deal with the problems involved in lighting straight stretches of Group A roads, bends and forks, double carriageways, bridges and tunnels and an open square or circus. He thought that although cut-off lighting might be demanded in special circumstances, it had found little favour in this country because of its additional cost and because the effect created lacked interest and was oppressive in the same way as the "tunnel" effect in industrial installations. Lanterns with high beam angles were no longer favoured,

Mr. L. C. Rettig



Illumination of Marischal College, Aberdeen

the medium beam angle lantern being used almost universally. An idea that had met with success was the use of fluorescent lanterns tilted at angles to the road width as a means of improving the overall brightness pattern on wide roads.

Group B Lighting

Referring to the need for improving Group B schemes, Mr. Rettig said that people had no conception of what a properly planned installation using top values of illumination could do in providing a high degree of safety for all road users and a very considerable amenity for the local inhabitants. "Craftsmen" would attack a Group B scheme with as much enthusiasm as they accorded to more spectacular work, and their standards of planning would be as high as elsewhere. They would not readily accept the inclusion in Group B of a road which, because of its frequency of use, should be lit to Group A standards or to the intermediate standard for which a small band of pioneers were endeavouring to obtain recognition. This progressive and proven standard deserved separate classification. Mr. Rettig advocated strongly that responsible engineers should be given more latitude than was possible if outdated Codes of Practice were to be rigidly applied. Because the tolerances allowed in the Codes of Practice were far too wide for general use, Mr. Rettig suggested that consideration should be given to a new method of classification which he showed in a table. In this it had been thought

	Group A plus	Group A	Intermediate	Group B
Fluorescent	4×80 3×80	2×80	3×40 4×30	2×40
Sodium	2×140	140	85	60
Fluorescent Bulb	400	250	125	80
Mercury	400	250	125	80
Tungsten	750	500	300	200
Spacing, ft	120 to 150	120	100 to 120	100

desirable to remove from both Groups A and B the lamps which at present gave less than 50 per cent of the light output range in each group. An "A plus" category had been introduced as a recognition of the type of street lighting which, because of Code limitations, was sometimes regarded as extravagant, but was actually now the normal requirement for traffic routes for many authorities. Mr. Rettig suggested that this type of classification would tend to raise the present inadequate levels of illumination allowable and would simplify the choice of light source. Additionally, the table headings were a better psychological presentation since only "adequate" and "excellent" standards of illumination were implied, sub-adequate standards receiving no recognition.

Opening the discussion on Mr. Rettig's paper Mr. D. R. Colvin (County of Lanark) emphasised that the true craftsman in public lighting must be an electrical engineer because in this advanced age of the modern discharge lamp a great deal more was required of the lighting engineer than an understanding of the Code of Practice and the ability to arrange the positions of lamps on a plan. The good engineer had also to maintain his installation as efficiently as possible. The installation on the dual carriageway at Lanark, which used 280 W sodium lamps on 35ft standards spaced at 170ft, should also be considered for single carriageways, he said, because the higher mounting heights made it possible to reduce the number of standards, which were a potential danger to motorists.

Mr. H. Carpenter (Blackpool Corporation) said that while the 170ft spacing for the new high intensity light sources might be satisfactory on motorways, where motorists were using dipped lights and there were restrictions on cyclists and pedestrians, it might be dangerous on inter-urban roads or built-up by-passes. In the use of conversion kits for existing gas columns there was a danger of perpetuating bad planning of column positions. In his suggested classification of public lighting the author had not dealt with mounting height. Perhaps this was because he felt that, having laid down a minimum for main traffic routes, the question of mounting height could safely be left to the lighting engineer. This could then permit an intermediate standard, which many people wanted.

Mr. J. R. Brodie (Ayr Town Council) suggested that it was wrong to use the word "craft" in this connection. Public lighting was a branch of municipal engineering, not a craft. One of the main obstacles in making measurements for the positioning of lamps was that almost every householder wanted a garage-way, so that schemes planned on paper did not work out in practice. He did not think that the Code of Practice was outdated, but if it were, it should be scrapped and a fresh code prepared.

Mr. A. W. Christie (Road Research Laboratory) said that the statement that cut-off lighting had found little favour in recent years was misleading. It might have found little favour in Great Britain, but it was regularly used on the Continent. It would be useful if comparable installations were set up in this country and the opinions of road users obtained. Such installations had recently been introduced in Brussels and delegates from a number of countries had inspected them and completed a questionnaire. The result was awaited with interest. He thought that lighting engineers in this country would admit that ultimately cut-off lighting, or something approaching it, would prevail.

Mr. L. R. Osgood (Luton) said that in the middle of a £50,000 scheme, well planned on paper, he had met complaints from ratepayers about the positioning of individual lamp standards and had been obliged to make changes.

Mr. H. F. Cork (Manchester Corporation) said that to overcome the confusion of a multiplicity of lights at a complicated road junction it might be better to floodlight the scene from the top of a 60ft pole. He emphasised that Group B lighting required just as careful planning as did Group A. Not enough was being done for the lighting of these minor roads.

Mr. J. M. Waldram (G.E.C. Research Laboratories)

recommended the use of a dendrometer for height measurement, and of a 35 mm camera for providing a record of garage entrances and shoplines which did not appear on normal plans. The B.S.I. Committee responsible for redrafting the Code was in session and was considering urgently many of the points raised.

The author, in his reply, said that the conversion kits for the use of gas columns cost only £6 or £7. In addition, it was often possible to reposition a column cheaply. In his opinion the cut-off system was oppressive. The answer to Mr. Osgood was to select a foreman with a very persuasive manner in his dealings with the public.

Aesthetics of Lighting

The outstandingly successful session of the conference was undoubtedly that on Thursday afternoon when Mr. J. E. Barlow's paper on "A Planner Looks at Public Lighting" and his critical comments on numerous installations provoked a forceful discussion. Mr. Barlow, who is the director of town planning at Aberdeen, explained that a planner was concerned, *ipso facto*, with the appearance of things around us, and that he himself spoke from the point of view of an architect-planner. For the most part his paper was a strong advocacy of the need for closer co-operation between the planner and the lighting engineer—such as had been successfully achieved in Aberdeen.

Mr. J. E. Barlow

Lighting had been excluded from control under the 1947 Act and therefore the lighting engineer had to exercise a degree of self-control. Nothing, Mr. Barlow emphasised, should replace the incentive and control of the man who was actually responsible for the installation, the lighting engineer, but he might well wish to be advised by someone who by training and experience was vitally concerned with design in relation to surroundings, to the three-dimensional closely integrated visual scene. Lighting was a team job with the result founded on mutual co-operation and appreciation.

Though there were many exceptions the overall impression one got of public lighting in Britain was first a feeling of technical efficiency, of good standards carefully arrived at and conscientiously applied; and secondly, a lack of visual sympathy for surroundings, of aggressively over-designed columns, of concrete used where no concrete should be, of drab housing areas made drabber by heavy poles and "pimply" fittings, of the universal "local authority green" paint. A lot of this was due to thoughtlessness, a case of the blind eye. Cost was not the reason because these things did not cost any less than something better designed and might in some cases cost more. Some of it was done in the spirit of "this is what it's going to be," in face of opposition expressed by planners and others. There had also been cases where planners had won the day to the detriment of lighting efficiency. Where due co-operation had taken place—as in the New Towns—the result had been lighting systems which in appearance and function appropriately played their important part in the life of the community.

In combating negative criticisms and woolly thinking on lighting matters, the lighting engineer now seemed to be receiving increasing assistance from the manufacturers. The basic fact that good design sprung naturally from successful handling of function and appropriate use of materials seemed at last to be well on the way to recognition. Much of the credit belonged to the Council of Industrial Design; but Mr. Barlow suggested that their imprimatur would be of greater value if it was made to apply to a manufacturer's whole catalogue and not just to a few individual columns or lanterns.

Mr. Barlow then went on to discuss examples of the different types of poles and lanterns available and the way in which they should best be used so that the layman might have as much assurance about the appearance of a lighting installation as he had about its efficiency. There were now a limited number of good, plain, straightforward concrete designs for the higher, major route, poles, but concrete standards had no place in central urban surroundings. There was a traditional element with steel lighting standards that was not present with concrete. Again, with fittings, manufacturers had evolved several designs for major routes which were satisfactory in shape and proportion and related well to the standards that supported them. With the lower grade of lighting Mr. Barlow complained that almost every example was a small-scale "blob" or "pimple" hanging disconsolately on the end of a pole several sizes too large for it. The whole business of minor route lighting was very disappointing. He thought it a pity that more use was not made of the pole-top fitting on a simple metal pole.

The discussion on Mr. Barlow's paper, which was listened to by a large audience, was opened by Mr. F. H. Clinch (Greenwich) who said he did not believe that æsthetic and technical considerations were necessarily in opposition, but if ever they were opposed, the technical consideration for good lighting must predominate. The new 200 W sodium linear lamp was a great achievement, but it brought with it problems of height and colour. Members of the Royal Fine Art Commission, commenting on an installation in Greenwich, had suggested that it would have been more in scale with the adjoining building if it had been 18ft instead of 25ft high. What would the reaction be to 35ft mounting height?

Many æsthetically-minded people had a strong objection to sodium lighting, with its "monochromatism," but this objection was not shared by the motorist. "The commodity which I am buying as a public lighting engineer is lumens," he said, "and I conceive it to be my duty to buy in the best market. Is there a valid objection to monochromatism in other than monumental settings?"

The Lord Provost and Mr. R. Parker talk with Mr. N. H. Bentley on the stand of A. H. Hunt (Capacitors), Ltd.

Commenting on lighting in historic towns, he submitted that in a medieval setting it was no more suitable to use a form of lighting 50 years old—an anachronism to which they had become accustomed—than to use something frankly modern. Electricity was modern, discharge lighting was completely contemporary, and it was architecturally deceitful to camouflage it. He had no time for concrete dressed up to resemble cast iron and for inefficient lanterns copying the shape and form of outmoded and outclassed gas lanterns. He hoped that the paper would mark the beginning of a new era of co-operation between the architect-planner and the public lighting engineer.

Mr. J. T. Grundy (Siemens Edison Swan, Ltd.) referred to a suggestion by Mr. Barlow that lighting engineers could produce their own designs. "If that were to happen," he said, "our costs of production and the cost to the user would rise sharply."

Mr. D. Clark (Norwich) showed some fine examples of concealed lighting used in the Civic Trust scheme in Norwich. He said that there were far too many dabblers in the design of street lighting installations. A number of authorities had planners who were not architects, and the dismal results of their work, with that of the dabblers in street lighting, could be seen in the countryside.

The electricity authorities had a slavish disregard for the finer points of craftsmanship in installation layouts. The clutter of conspicuous sites for services and large control boxes needed much more thought. The Electricity Boards usually carried only what they termed standardised equipment, which was most frustrating when the engineer wanted a well-designed installation with materials which any reputable electrical contractor would carry in stock. For instance, when it had been found that the Board's relay could not be housed in certain concrete lamp columns, they had requested the local authority to pass a resolution to fit only columns with large base compartments which would house the relay!

Mr. P. Whitworth (Council of Industrial Design) said that good design was a question of informed opinion. He paid a tribute to the manufacturers represented at the conference for the great progress which they had made with their equipment. "We feel in the Council that now is the time for us to have an open-air exhibition of street furniture," he said, "much on the lines of the Design Centre, and we hope to do this during the next year. The revision of the approved list is also on the way."

Mr. F. H. Pulvermacher (South Wales Electricity Board) appealed for the use of more brackets rather than poles. Everyone seemed to think that poles were essential, but the lighting engineer was interested only in the 20 to 25 lb of lantern at the top of the pole, not in the 25 cwt or so apparently required to keep it there.

Mr. J. R. Brodie (Ayr) said there was no need for the lighting engineer to consult anyone about his job. The Paper was the beginning of a process of encroachment by planners on the lighting engineer's job, and this should be resisted.

Alderman P. H. Renwick (Newcastle) said that while he hoped there would be co-operation with the planners, they must give first priority to ending the high mortality rate on the roads. Safety on the roads must come first; beauty was a secondary factor.

Mr. R. J. Fothergill (Victor Products (Wallsend), Ltd.) commented on Mr. Barlow's suggestion that the lanterns in Union Street, Aberdeen, should be painted blue. Few people noticed anything in the street, he said, if it were more than 15° above the horizontal.

Mr. Barlow, in reply, agreed that technical considerations must take priority but stressed the need to use the right materials in the right way. If functional requirements were that poles must be 25ft high, the planner must accept them. Similarly, if there were strong technical reasons for using monochromatism, the average planner would accept it, apart from particular circumstances. He was not opposed to the use of concrete posts within a town, where they could be made to look urbane. His only criticism was that many of the standards he had so far seen did not come within that category.

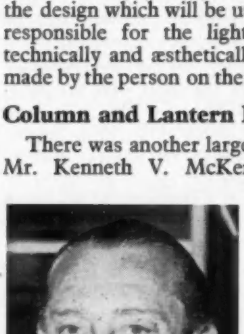
He agreed that, on the face of it, it was wrong to use an outmoded type of fitting and to convert it to electricity, as had been done on the Bridge of Dee. The difficulty was that when this work was done, nothing better was available.

It was true that lighting efficiency was the fundamental consideration, but in parts of cities having great charm, such as Old Aberdeen, there were strong reasons for bearing other considerations in mind. Surely there could be a marriage between technical and æsthetic considerations. Where this was not possible, the two considerations should be carefully weighed against each other.

"I am very concerned," he said, "about the practice of firms not only quoting for an installation but deciding on the design which will be used. Only the man on the spot, responsible for the lighting, knows what is required technically and æsthetically. The final decision must be made by the person on the spot."

Column and Lantern Erection

There was another large audience on the last day when Mr. Kenneth V. McKenzie (manager, Iver Lighting Depot, General Electric Co., Ltd.) presented his paper on "Some Practical Aspects of Street Lighting Column and Lantern Erection." He did not seek to advocate the use by local authorities of an erection contractor as against the employment of direct labour, since, in his view, both systems were admirable. Rather, by taking his audience through each step involved in erection work he enabled them to appreciate more clearly the amount of careful planning and organisation that lay between the initial plan and the completed installation. From his own experience he made a number of suggestions for reducing or avoiding many of the difficulties encountered.



Mr. K. V. McKenzie

It was, he stressed, important that there should be early consultation between the erection engineer and the lighting engineer. A trial installation could give useful information, and might lead to a substantial saving of time and money especially where it was known there were many underground services. The author favoured the use of two teams: one to erect the columns and brackets; the other, an electrical team, following three days behind fitting and wiring the lanterns, lamps and gear. This avoided the position of the columns being disturbed before the concrete had "gone off." He had also found it more practical, for erection work, to use a separate tower-ladder on a trailer rather than a prime-mover tower vehicle, which was, however, excellent for maintenance work. To enable them to test the wiring of the columns and lanterns, before the supply was connected, the author

had found it satisfactory for each electrical team to carry its own specially made test set. This consisted of a simple rotary-convertor set, the input side being energised by a 24 V d.c. supply with an output of 250 V a.c. 50 c/s, capable of variation down to 200 V, and fitted with two voltmeters, input and output, and an output ammeter.

Referring to the work of the erection team in removing old columns, Mr. McKenzie said that he had found many of the old steel columns to be in a very dangerous state. In conclusion, he indicated some of the legal aspects of the work and the insurances needed.

Opening the discussion Mr. E. J. Whitcher (London Electricity Board) said that direct labour was more expensive. Local authorities would save themselves a lot of money by early consultation with their Electricity Board. The modern trend was towards streamlining jobs, doing them all in one go and as much as possible in the factory. Mr. J. T. Grundy (Siemens Edison Swan) said the absence of legal disputes was an indication of the goodwill in the industry. Mr. D. Clark (Norwich) suggested that a forward crank was a better method than a backward crank since it could usually be fitted without any obstruction from other services. Mr. A. L. Percy (Huddersfield) emphasised that co-ordination of work could secure economies by reducing the need for pulling up roads, which were never as good afterwards.

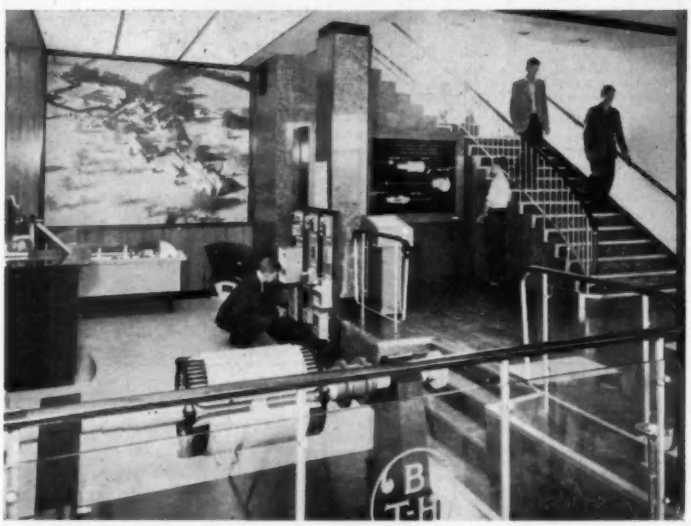
MINISTER OPENS NEW RUGBY BUILDINGS

DURING a visit last week to Rugby the Minister of Education, Mr. Geoffrey Lloyd, officially opened the Education Building which forms the centre for the British Thomson-Houston Co.'s training of technical apprentices. After unveiling a commemorative plaque, the Minister toured the building and saw student apprentices attending lectures and tutorials and also at work in the heavy plant factory by means of closed circuit television. The entrance hall of the building includes an exhibition area in which the company's products and those of allied industries are displayed. Murals depict aerial views of Coton House, the company's apprentice residence, and some of the main factories.

In the administration offices of the Education Department on the first floor, tutorials and lectures are planned, with liaison with the Rugby technical college where the academic parts of all apprentice sandwich courses are carried out. On the second floor are two lecture rooms, accommodating 80 and 50 students, and two tutorial rooms. The building has been planned to permit extensions incorporating the training drawing office, at present in a separate building, and a lecture room for approximately 250 students. There are at present 2,093 apprentices, comprising 894 craft, 720 technician, 333 student and 146 graduate, in the company's various training schemes.

During the afternoon an assembly hall, common room and two student residences were formally opened at the Rugby College of Technology and Arts, which during next year will be divided into two separate colleges, the East Warwickshire College of Further Education and the Rugby College of Engineering Technology, the present building becoming the engineering college. The halls of residence are the first of their kind to be built at a technical college under the ægis of a local education authority.

The Minister, accompanied by Lord Chandos, inspecting exhibits in the new B.T.H. building



Speaking at the opening ceremony, Mr. Lloyd congratulated those concerned on the close partnership which they had established with the local industry, and he went on to say that new technical college buildings are being opened at the rate of one a week. The number of sandwich courses has grown from about 70 in 1955 to over 300 this session, and the number of students taking advanced courses is increasing rapidly; there are 137 students in their final year of the Diploma of Technology course and nearly 1,200 in their first year.

The exhibition area in the entrance hall of the B.T.H. Education Building

DOMESTIC ELECTRICAL EQUIPMENT

BLANKETS AND PADS

THE number of manufacturers of electric blankets listed in the following survey is an indication of the growing popularity of this particular item of domestic electrical equipment and, with the start of autumn, sales figures are again expected to increase rapidly. There are now well over 200 different models from which to make a choice, ranging in price from approximately £3 10s for single bed sizes, to upwards of £15 for double bed models with dual switches that provide for separate control of each half.

Electric blankets are of two kinds—thermostatically controlled models, with a relatively high loading, that heat up quickly, and those with a lower wattage rating which employ a self-compensating type of element. With the last-mentioned types the design is such that the generated heat does not exceed a temperature above approximately 140/150°F, irrespective of how long the blanket is left switched on. Providing the simple operating instructions are observed, electric blankets are completely safe in use. The elements are, in most cases, encased in plastics (p.v.c.), asbestos or fibreglass. All pass the B.S.I. safety tests but only p.v.c. is considered to be completely waterproof.

Apart from size, the main difference in the prices of electric blankets may be accounted for by the addition of certain refinements such as raised figures on the switches so that the blanket can be heat controlled in the dark; temperature regulators to enable one temperature to be maintained over a period; pilot lights in the form of neon tubes in the switches; washable covers; and, in the case of low-voltage models, the provision of a transformer.

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
AJAC ELECTRICAL PRODUCTS, LTD., Morley Road, Llandudno.	"Ajac" P.100, G.101 and G.102	48×33	75 W	Non-thermostatic (G.102 neon switch)	Pink	Raised cotton	Element to B.S.S.2612	£3 1 8 (P.100) £3 8 10 (G.101) £3 13 6 (G.102)	£0 11 3 (P.100) £0 12 7 (G.101) £0 13 6 (G.102)
	"Ajac" G.103	54×30	75 W	Non-thermostatic	Pink	Raised cotton	Element to B.S.S.2612	£3 8 10	£0 12 7
	"Ajac" G.104	66×48	150 W	Non-thermostatic	Pink	Raised cotton	Element to B.S.S.2612	£6 4 0	£1 3 3
	"Ajac" G.105	24×20	25 W	Non-thermostatic	Pink	Raised cotton	Element to B.S.S.2612	£1 7 2	£0 5 2
H. J. BALDWIN & CO., Ltd., 132, Arkwright Street, Nottingham.	"Thermat Regal"	60×30 (a) 60×48 (b)	85 W (a) 135 W (b)	Non-thermostatic	Pink or blue	Wool mixture	Made to B.S.S.2612, neon switches	£3 18 0 (a) £5 14 6 (b)	£0 14 3 (a) £1 0 9 (b)
	"Thermat De-luxe"	60×30 (a) 60×48 (b)	85 W (a) 135 W (b)	Non-thermostatic, three-heat (a), dual control (b)	Pink or blue	Wool mixture	Made to B.S.S.2612, neon switches	£6 11 0 (a) £11 9 0 (b)	£1 3 9 (a) £2 1 6 (b)
	"Thermat Lylux" P.1	48×26	50 W	Non-thermostatic	Pink	Raised cotton	S/P switch	£2 9 9	£0 8 0
	"Thermat Lylux" D.1	54×42	100 W	Non-thermostatic	Pink	Raised cotton	D/P neon switch	£4 3 0	£0 13 6
BEST PRODUCTS, LTD., Felix Works, Felixstowe, Suffolk.	"Best" blanket	60×30	80 W	Self-compensating element	Apricot	Duplex rayon	One-piece element, d.p. switch	£4 15 6	£0 17 5
	"Best" mattress overlay	60×30	90 W	Self-compensating element	Maroon figured	Cotton damask	One-piece element, d.p. switch	£4 6 1	£0 15 9
BESTFRIEND ELECTRICAL CO., LTD., Diceland Works, Banstead, Surrey.	"Luxecon" single	60×30	78 W	D/P neon illuminated switch	Various pastel shades	Raised cotton	Made to B.S.S.2612	£3 19 6	£0 14 6
	"Luxecon" double	60×50	130 W	D/P neon illuminated switch	Various pastel shades	Raised cotton	Made to B.S.S.2612	£5 19 6	£1 1 10
BLANELLA, LTD., Thorp Arch Mill, Boston Spa, Yorks.	"Cozee Cumfort" single	24×54	58 W	Single-heat	Pastel pink and blue	Flameproofed wool mixture	Made to B.S.S.2612	£2 12 10	£0 9 8
	"Cozee Cumfort" double	44×54	114 W	Single-heat	Pastel pink and blue	Flameproofed wool mixture	Made to B.S.S.2612	£3 19 11	£0 14 7
BRITISH VACUUM CLEANER & ENG. CO., LTD., Goblin Works, Leatherhead, Surrey.	"Goblin" B.1	52×27	60 W	Single-heat	Blue or pink	Fleecy mixture	Made to B.S.S.2612	£4 2 5	£0 15 1
	"Goblin" B.2	52×42	85 W	Single-heat	Blue or pink	Fleecy mixture	Made to B.S.S.2612	£5 17 1	£1 1 5
	"Goblin" G	52×30	60 W	Three-heat	Blue or pink	Fleecy mixture	Made to B.S.S.2612	£6 2 7	£1 2 5
	"Goblin" GT	60×45	90 W	Three-heat	Blue or pink	Fleecy mixture	Made to B.S.S.2612	£8 15 5	£1 12 1

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
BULPITT & SONS, LTD., St. George's Works, 132, Icknield Street, Birmingham, 18.	712A	60×30	90 W	Thermal balance	Pink, peach or pastel blue	Raised cotton	Made to B.S.S.2612	£4 3 8	£0 15 4
	714A	60×50	135 W	Thermal balance	Pink, peach or pastel blue	Raised cotton	Made to B.S.S.2612	£6 3 0	£1 2 6
CHALFONT ELECTRICAL PRODUCTS, LTD., Tyrrell Street, Leicester.	"Junior" single (a), double (b)	48×26 (a), 48×39 (b)	60 W (a), 90 W (b)	Single-heat switch	Pink or peach	Fleecy mixture	Satin ribbon binding	£2 15 6 (a) £3 12 0 (b)	£0 10 1 (a) £0 13 2 (b)
	"Warmster" single (a), double (b)	60×24 (a), 60×42 (b)	70 W (a), 130 W (b)	Single-heat switch	Pink or peach	Fleecy mixture	Waterproof, satin ribbon binding	£4 0 0 (a) £6 0 0 (b)	£0 14 7 (a) £1 1 11 (b)
	"De-Luxe" single (a), double (b)	60×33 (a), 60×51 (b)	140 W (a), 220 W (b)	Thermostatic, three-heat switches	Pink, peach or blue	Wool	Satin ribbon binding, waterproof, dual control (b)	£8 15 0 (a) £14 8 8 (b)	£1 12 0 (a) £2 12 9 (b)
E. K. COLE, LTD., 5, Vigo Street, London, W.1.	"Juno"	50×30	50 W	Normal heat dissipation	Pink or blue	Fleecy cotton, flameproofed	D/P switch, covers available	£2 7 6	£0 10 5
	"Sylvia"	60×33	72 W	Normal heat dissipation	Pink or blue	Fleecy cotton, flameproofed	Neon D/P switch, covers available	£3 15 0	£0 13 7
	"Diana"	60×51	116 W	Natural heat dissipation	Pink or blue	Fleecy cotton, flameproofed	Neon D/P switch, covers available	£5 2 6	£0 18 6
	"Sherborne"	60×31	72 W	Natural heat dissipation	Pink, blue and green	Wool mixture, flameproofed	Neon D/P switch, covers available	£4 15 0	£0 17 2
	"Dorchester"	60×51	132 W	Natural heat dissipation	Pink, blue and green	Wool mixture, flameproofed	Neon D/P switch, covers available	£6 12 6	£1 3 11
	"Vigilux" single (a), double (b) and twin (c)	65×36 (a), 72×58 (b & c)	78 W (a), 140 W (b), 2×69 W (c)	Variable thermostat control circuit	Pink, blue and green	Wool mixture, flameproofed	Illuminated temperature control box, D/P switch, covers available	£8 10 0 (a) £12 10 0 (b) £14 0 0 (c)	£1 10 9 (a) £2 5 2 (b) £2 10 7 (c)

1. *Blanella "Cozee Cumfort" blanket*
2. *H. J. Baldwin & Co.'s "Thermat Regal" blanket*
3. *Bulpitt "Swan Brand" blanket*
4. *"Dorchester" blanket from E. K. Cole's "Warm-Glow" range*

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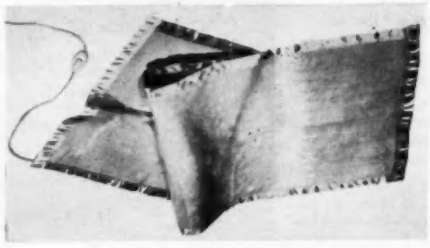

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Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
CREATORS, LTD., Albert Drive, Sheerwater, Surrey.	"Plansel"	48×24	60 W	Non-thermostatic	Pink or blue	Blanket cloth	2-year guarantee	£2 8 7	£0 8 11
DENHAMS (NORWICH), LTD., All Saints Road, Acton, W.3.	"Norvic" pad P.3	12×16	65 W	Thermostatic, three-heat	Pink or blue	Felt base, flannelette (fireproof)	Detachable cover. Made to B.S.S.2612	£3 11 0	£0 13 0
	"Norvic" single S.3	30×56	95 W	Thermostatic, three-heat	Pink or blue	Felt base, flannelette (fireproof)	Detachable cover. Made to B.S.S.2612	£7 2 0	£1 6 0
	"Norvic" double D.R.3	50×60	128 W	Three-heat switches	Pink or blue	Cotton base, flannelette (fireproof)	Dual-control. Made to B.S.S.2612	£10 13 0	£1 19 0
	"Norvic" single T.3	30×56	95 W	Thermostatic, three-heat	Pink or blue	Cotton base, wool (fireproof)	Made to B.S.S.2612	£6 4 3	£1 2 9
	"Norvic" 12 V all-night L.3	30×60	84 W	Three-heat through transformer	Pink or blue	Cotton base (fireproof)	Price includes transformer	£9 15 2	£0 14 10
	"Norvic" 12 V all-night D.L.3	50×60	128 W	Three-heat through transformer	Pink or blue	Cotton base (fireproof)	Price includes transformer	£15 5 7	£1 4 5
	"Corona" single C.3	30×52	72 W	Three-heat	Pink or blue	Cotton base (fireproof)	Flannelette cover. Made to B.S.S.2612	£4 1 2	£0 14 10
	"Corona" double C.D.3	45×58	122 W	Three-heat	Pink or blue	Cotton base (fireproof)	Flannelette cover. Made to B.S.S.2612	£6 12 9	£1 4 3
EASIPOWER APPLIANCES, LTD., 30, High Street, Southampton.	"Dreamland" standard single	60×30	90 W	Non-thermostatic	Peach	Wool/rayon mixture	—	£4 0 0	£0 13 11
	"Dreamland" neon single	60×30	90 W	Non-thermostatic	Peach	Wool/rayon mixture	Illuminated switch	£4 1 4	£0 14 2
	"Dreamland" standard double	60×48	130 W	Non-thermostatic	Peach	Wool/rayon mixture	—	£6 0 0	£1 0 10
	"Dreamland" neon double	60×48	130 W	Non-thermostatic	Peach	Wool/rayon mixture	Illuminated switch	£6 2 3	£1 1 3
	"Dreamland" de-luxe single	60×30	90 W	3-heat	Peach	Wool/rayon mixture	—	£5 10 9	£0 19 3
	"Dreamland" de-luxe double	60×48	130 W	3-heat	Peach	Wool/rayon mixture	—	£8 1 0	£1 8 0

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5. *Electric Bedwarmers "Bedtime Bliss" blankets*
6. *Denhams "Norvic" low voltage blanket with transformer*
7. *David Griffin low voltage blanket with transformer*
8. *Easipower Appliances "Dreamland" blanket*

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
ELECTRIC BED-WARMERS, LTD., Quality Works, Waterside, Todmorden, Lancs.	"Bedtime Bliss" single	30×54	120 W	Three-heat switch	Pink, blue, gold or green	Duplex cloth whipped with wool	"Calomatique z" long-life element	£5 4 6	£0 17 11
	"Bedtime Bliss" double	50×60	200 W	Two three-heat switches, dual control	Pink, blue, gold or green	Duplex cloth whipped with wool	"Calomatique z" long-life element, dual-control	£10 9 0	£1 15 10
	"Calora" pad De-luxe major	13×8	80 W	Three-heat switch	White	Duplex cloth	Guaranteed two years	£3 2 3	£0 10 8
	"Calora" single	54×27	90 W	On/off switch	Pink or blue	Raised fabric	"Calomatique z" long-life element	£3 3 7	£0 11 7
	"Calora" double	60×42	160 W	On/off switch	Pink or blue	Raised fabric	"Calomatique z" long-life element	£6 0 0	£1 0 10
S. I. ENGEL & CO., 23-5, Kensington Park Road, London, W.11.	"L'Exquisite"	12×16	60 W	Three-heat switch	White	Flannelette	Complete with washable cover, two thermostats	£2 0 8	£0 6 10
DAVID GRIFFIN, LTD., Wimborne Road, Poole, Dorset.	"Dee Gee" SB/SU	70×34	105 W	Three-heat switch through transformer	Pink and blue	Wool mixture	Operates at 12 V	£9 9 3	£0 17 3
	"Dee Gee" TSB/DU	70×34 (twin)	2×105 W	Three-heat switch through transformer, dual control	Pink and blue	Wool mixture	Operates at 12 V	£17 17 6	£1 14 6
	"Dee Gee" DB/DU	70×54	2×90 W	Three-heat switch through transformer, dual control	Pink and blue	Wool mixture	Operates at 12 V	£17 0 4	£1 11 5
	"Dee Gee" DB/TSU	70×54	2×90 W	Three-heat switch through transformer, dual control	Pink and blue	Wool mixture	Operates at 12 V	£18 1 4	£1 11 5
HALL & VERET, LTD., 434, Rochester Way, Sidcup, Kent.	"Veret" bedwarmer	9×3	6·5 W	Thermostatic	Red and black mottled container	Toughened heavy gauge Bakelite	Suppressed for radio and T.V.	£1 17 6	£0 6 11
H.M.V. HOUSEHOLD APPLIANCES, Hayes, Middlesex.	SBI	24×60	60 W	Neon on/off switch	Fawn, pink satin edge	Wool	Made to B.S.S.2612	£4 8 9	£0 16 3
	DBI	43×60	108 W	Neon on/off switch	Fawn, pink satin edge	Wool	Made to B.S.S.2612	£6 11 0	£1 4 0
HOLT ENGG. & MANUFACTURING CO., LTD., Hemco Works, 210, Stockport Road, Manchester, 13.	"Hesco"	17×11 (a), 22×14 (b), 22×14 (c)	33 W (a), 30 W (b), 60 W (c)	Single-heat switch (a & b), three-heat switch (c)	Fawn	Woollen	White linen and/or waterproof cover 5/- extra	£3 0 0 (a) £3 10 0 (b) £3 15 0 (c)	£0 7 4 (a) £0 12 9 (b) £0 13 8 (c)
	"Hesco"	47×32	125 W (a), 260 W (b)	Single-heat switch (a), three-heat switch (b)	Fawn	Woollen	White linen and/or waterproof cover £1 extra	£5 0 0 (a) £6 15 0 (b)	£0 18 2 (a) £1 4 8 (b)
	"Hesco"	60×48	520 W	Three-heat dual switch	Fawn	Woollen	White linen and/or waterproof cover 30/- extra	£12 0 0	£2 3 10
ROBERT HOLT (MIDDLESEX), LTD., Florence Road, Edmonton, N.18.	"Solwarm" No. 1	52×54	150 W	Duplicate thermostats, variable control £2 extra	Pink/peach	Cotton	Washable cover 29/6 extra	£6 5 10	£1 1 8
	"Solwarm" No. 3	28×52	70 W	Single-heat and thermostats	Pink/peach	Cotton	Washable cover 14/9 extra	£3 6 1	£0 11 5
	"Solwarm" No. 4	18×52	50 W	Single-heat and thermostats	Pink/peach	Cotton	Washable cover 10/6 extra	£2 17 6	£0 10 0
	"Solwarm" No. 5	16×12	20 W.	Thermostatic	Pink/peach	Cotton	Cover available	£1 9 8	£0 5 2
	"Solwarm" L.2	45×52	120 W	Thermostatic, variable control £2 extra	Pink/peach	Cotton	Washable cover 24/6 extra	£4 9 6	£0 15 6
DAVID HOPE & CO., LTD., Nugent Street, Leicester.	"Nelson"	60×33	140 W	Three-heat switch and thermostat	White	Rayon	—	£7 10 0	£1 7 4

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
HURSEAL, LTD., 229, Regent Street, London, W.1.	"Hurseal" bed sheet, single	60×33	140 W	Three-heat switch, thermostatic	White, pink or blue	Cotton/rayon mixture	Washable	£7 10 0	£1 7 5
	"Hurseal" bed sheet, double	60×51	220 W	Three-heat switch, thermostatic	White, pink or blue	Cotton/rayon mixture	Washable, individual control each side	£12 16 0	£2 6 10
ISOPAD, LTD., 3, Rosemont Road, London, N.W.3.	"Lana" BS	60×80 (36×54 heated)	100 W	Three-heat switch	Pink, green and blue	Pure wool	Made to B.S.S.2612	£9 0 0	£1 12 10
	"Lanette" single	36×54	100 W	Three-heat switch	Pink, green and blue	Pure wool	Made to B.S.S.2612	£6 0 0	£1 2 0
	"Lanette" double	60×54	160 W	Dual control, three-heat switches	Pink, green and blue	Pure wool	Made to B.S.S.2612	£11 0 0	£2 0 2
KELVIN-NORTON ELECTRIC CO., LTD., Safetex Works, Barbauld Street, Warrington.	"Safety-first" single	54×30	90 W	Three-heat switch	Pastel green	Rayon and raised cotton	Low voltage through 240–24–17–12 V transformer	£11 10 3	£0 16 6
	"Safety-first" double	54×44	125 W	Three-heat switch	Pastel green	Rayon and raised cotton	Low-voltage through 240–24–17–12 V transformer	£12 19 0	£1 1 7
	"Safety-first" double De-Luxe	60×54	2×75 W	Two three-heat switches	Pastel green	Rayon and raised cotton	Low-voltage through 240–24–17–12 V transformer	£16 16 0	£1 8 7
F. MARSHALL (TEXTILES), LTD., Hollins Mill, Marsh, Huddersfield.	"Martex" single Kite	26×56	62 W	Single-heat D/P switch	Pastel pink	Cotton and rayon, flameproofed	Made to B.S.S.2612	£3 14 8	£0 13 8
	"Martex" double Kite	50×56	2×62 W	Single S/P switch each half	Pastel pink	Cotton and rayon, flameproofed	Made to B.S.S.2612	£6 10 5	£1 3 10
	"Martex" three-quarter Kite	37×50	77 W	Single-heat D/P switch, neon	Pastel pink	Cotton and rayon, flameproofed	Made to B.S.S.2612	£3 15 4	£0 13 9
	"Martex" single	26×50	62 W	Single-heat D/P switch	Pastel pink	Cotton and rayon, flameproofed	—	£2 15 4	£0 10 1
	"Martex" double	48×50	2×62 W	Single S/P switch each half	Pastel pink	Cotton and rayon, flameproofed	—	£5 3 7	£0 18 11
MILLIWATT, LTD., 44, Princess Road, Regent's Park, London, N.W.1.	"Milliwatt" standard pad	13½×15	80 W	Three-heat duplicate thermostats	White, pink, blue, green, cream	Wool felt interior	Washable waterproof cover	£3 0 0	£0 10 10
	"Milliwatt" standard pad	13½×15	40 W	Single-heat duplicate thermostats	White, pink, blue, green, cream	Wool felt interior	Washable waterproof cover	£1 15 0	£0 6 4
	"Milliwatt" double pad	15×26	100 W	Three-heat duplicate thermostats	White, pink, blue, green, cream	Wool felt interior	Washable waterproof cover	£4 15 0	£0 17 2
	"Milliwatt" double pad	15×26	50 W	Single-heat duplicate thermostats	White, pink, blue, green, cream	Wool felt interior	Washable waterproof cover	£3 5 0	£0 11 9
	75	24×50	70 W	Single-heat duplicate thermostats	Pink, blue, green or cream	Wool felt interior	Fleecy or "Vynide" cover	£3 15 0	£0 13 6
	95/1	50×48	130 W	Single-heat duplicate thermostats	Pink, blue, green or cream	Wool felt interior	Fleecy or "Vynide" cover	£7 5 0	£1 6 2
	95/3	50×48	160 W	Three-heat duplicate thermostats	Pink, blue, green or cream	Wool felt interior	Fleecy or "Vynide" cover	£8 13 4	£1 11 4
	Standard single	30×50	100 W (a), 140 W (b)	Single-heat (a), three-heat (b) duplicate thermostats	Pink, blue, green or cream	Wool felt interior	Fleecy or "Vynide" cover	£5 0 0 (a) £6 10 0 (b)	£0 18 0 (a) £1 3 6 (b)
	Dual control double	50×60	200 W (a), 280 W (b)	Single-heat (a), three-heat (b) duplicate thermostats	Pink, blue, green or cream	Wool felt interior	Fleecy or "Vynide" cover	£13 0 0 (a) £16 0 0 (b)	£2 7 0 (a) £2 17 9 (b)
	"Extra"	60×30	100 W	Three-heat duplicate thermostats	Pink, blue, green or cream	Wool felt interior	Fleecy or "Vynide" cover	£5 0 0	£0 18 0
	Double "Extra"	60×48	160 W	Three-heat duplicate thermostats	Pink, blue, green or cream	Wool felt interior	Fleecy or "Vynide" cover	£7 3 9	£1 6 3
	"Autocrat"	60×24	100 W	Five-position three-heat switch	Pink, gold or blue	Wool mixture	—	£2 15 6	£0 10 0

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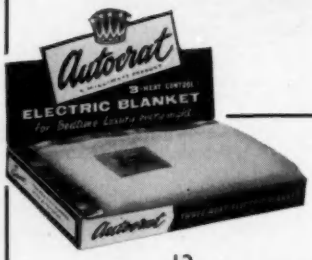

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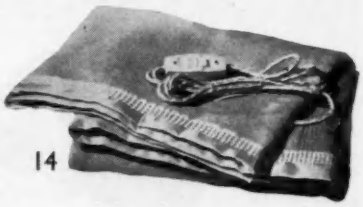

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9. *Kelvin Norton "Safety-First" blanket with transformer*
10. *F. Marshall "Mar-Tex" blanket*
11. *Hurseal electric washable bed sheet*
12. *Modern Electrical Industries "Warmabed" de-luxe blanket*
13. *Milliwatt "Autocrat" blanket*
14. *Morphy-Richards Series III "Regent" blanket*

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
MODERN ELECTRICAL INDUSTRIES, LTD., Hollingworth Lane, Knottingley, Yorks.	"Warmabed" de-luxe double	60×44	135 W	Single (a) or three-heat (b) switches (neon)	Honeysuckle, periwinkle blue, green and pink	All wool	All blankets made to B.S.S.2612. Five-heat conversion units available, price £3 3s and £3 17s 6d (with standard lamp) extra	£10 8 0 (a) £11 12 0 (b)	£1 17 7 (a) £2 1 10 (b)
	"Warmabed" de-luxe single	60×28	90 W	Single (a) or three-heat (b) switches (neon)	Honeysuckle, periwinkle blue, green and pink	All wool		£7 4 0 (a) £8 0 0 (b)	£1 6 0 (a) £1 8 10 (b)
	"Warmabed" de-luxe small single	40×20	45 W	Single-heat switch (neon)	Honeysuckle, periwinkle blue, green and pink	All wool		£4 0 0	£0 14 5
	"Warmabed" "Golden Rest"	60×44 (a), 60×28 (b)	135 W (a), 90 W (b)	Single-heat D/P switch	Honeysuckle	Flame-proofed brushed cotton		£5 11 0 (a) £3 14 0 (b)	£1 0 0 (a) £0 13 4 (b)
MORPHY-RICHARDS, LTD., 50, Conduit Street, London, W.1.	"Popular" BBU Series III	48×26	91 W	Single-heat switch	Pink	Cotton	Series II blankets, a.c./d.c. Series III blankets, a.c. only. Series III blankets made to B.S.S.2612. Satin bound edges to all models	£3 0 0	£0 10 10
	"Popular" BCU Series III	48×42	159 W	Single-heat switch	Pink	Cotton		£3 17 6	£0 14 0
	"Regent" BSU Series II (a), Series III (b)	60×26	70 W (a), 115 W (b)	Single-heat switch	Peach, pink, blue	Wool mixture (a) fleecy material (b)		£4 0 0 (a) £4 10 0 (b)	£0 14 5 (a) £0 16 3 (b)
	"Regent" BDU Series II (a), Series III (b)	60×45	130 W (a), 219 W (b)	Single-heat switch	Peach, pink, blue	Wool mixture (a) fleecy material (b)		£6 0 0 (a) £6 10 0 (b)	£1 1 8 (a) £1 3 6 (b)
	"Imperial" BEU Series II (a), Series III (b)	60×28	70 W (a), 124 W (b)	Three-heat switch	Peach, pink, blue	Wool mixture (a) fleecy material (b)		£5 5 0 (a) £5 12 6 (b)	£0 18 11 (a) £1 0 4 (b)
	"Imperial" BFU Series II (a), Series III (b)	60×47½	130 W (a), 228 W (b)	Three-heat switch	Peach, pink, blue	Wool mixture (a) fleecy material (b)		£7 10 0 (a) £8 0 0 (b)	£1 7 1 (a) £1 8 10 (b)
MOSSLEY BLANKET & CARPET CO., LTD., Kosywol House, Mossley, Nr. Manchester. (continued on next page)	"Kosywol" single	54×27	75 W	Neon (a) or non-illuminated (b) D/P switch	Rose, blue, green	Fibro blend wool content	Waterproof element	£2 16 4 (a) £2 12 3 (b)	£0 10 2 (a) £0 9 5 (b)

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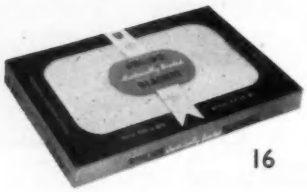

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15. *Thermalux mattress overlay*
16. *Philips single-bed blanket*
17. *Pifco "Popular" blanket*
18. *Stanley Bros. "Cumfee" de-luxe blanket*

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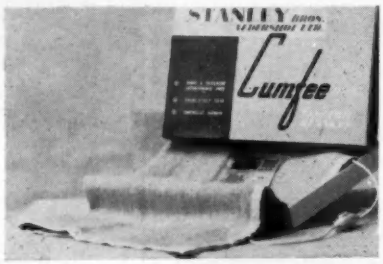

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Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
MOSSLEY BLANKET & CARPET CO., LTD., Kosywol House, Mossley, Nr. Manchester. *(continued)*	"Kosywol" double	54×48	150 W	Neon (a) or non-illuminated (b) D/P switch	Rose, blue, green	Fibro blend wool content	Waterproof element	£4 18 2 (a) £4 14 1 (b)	£0 17 9 (a) £0 17 0 (b)
	"Kingfisher" single	54×27	75 W	Neon D/P switch	Red or blue	All wool velour	Waterproof element	£4 3 4	£0 15 0
	"Kingfisher" double	54×48	150 W	Neon D/P switch	Red or blue	All wool velour	Waterproof element	£6 8 4	£1 3 2
	"Kosywol" L.V.1 single	54×27	75 W	24 V on/off switch	Rose, blue, green	Fibro blend wool content	Three-heat, low-voltage control unit £6 13s 6d extra	£3 15 0	£0 13 6
	"Kosywol" L.V.2 double	54×48	150 W	24 V on/off switch	Rose, blue, green	Fibro blend wool content	Three-heat, low-voltage control unit £6 13s 6d extra	£5 5 10	£0 19 1
NORRAND, LTD., Clayton Lane, Bradford, 5, Yorkshire.	"Westminster"	54×27	67 W	D/P neon switch	Pink	Fleecy cotton, bias bound	Three-year guarantee, washable cover 12/11	£2 9 0	£0 8 10
PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2.	EA.1213 single	60×28	75 W	Three-heat switch	Peach	Pure wool	Natural heat dissipation	£6 0 6	£1 2 0
	EA.1223 double	60×48	130 W	Three-heat switch	Peach	Pure wool	Natural heat dissipation	£9 9 4	£1 14 8
	EA.1210 single	60×25	72 W	Single-heat	Gold	Fleecy wool	Natural heat dissipation	£4 8 2	£0 16 1
	EA.1220 double	60×43	125 W	Single-heat	Gold	Fleecy wool	Natural heat dissipation	£6 9 2	£1 3 7
PIFCO, LTD., Watling Street, Manchester, 4.	"Favourite" 1267 single	48×26	56 W	Self-compensating element	Gold, pink and eau-de-nil	Heavy cotton twill	Satin binding. Made to B.S.S.2612	£2 15 5	£0 10 1
	"Favourite" 1268 double	48×40	90 W	Self-compensating element	Gold, pink and eau-de-nil	Heavy cotton twill	Satin binding. Made to B.S.S.2612	£3 11 10	£0 13 2
	"Popular" 1167 single	60×24	63 W	Self-compensating element	Gold, pink and eau-de-nil	Wool and cotton mixture	Satin binding. Made to B.S.S.2612	£3 19 11	£0 14 7
	"Popular" 1168 double	60×42	120 W	Self-compensating element	Gold, pink and eau-de-nil	Wool and cotton mixture	Satin binding. Made to B.S.S.2612	£6 0 1	£1 1 11
	"De-Luxe" 2263 single	62×28	120 W	Thermostatic	Gold, peach, powder blue	Pure wool	Satin binding. Made to B.S.S.2612	£7 3 9	£1 6 3
	"De-Luxe" 2264 double	62×42	186 W	Thermostatic	Gold, peach, powder blue	Pure wool	Satin binding. Made to B.S.S.2612	£10 8 0	£1 18 0

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
PIFCO, LTD., Watling Street, Manchester, 4. *(continued)*	"Favourite" 2367 single three-heat	40×27	56 W	Self-compensating element	Gold, pink and eau-de-nil	Heavy cotton twill	Satin binding. Made to B.S.S.2612	£3 11 10	£0 13 2
	"Favourite" 2368 double three-heat	48×42	90 W	Self-compensating element	Gold, pink and eau-de-nil	Heavy cotton twill	Satin binding. Made to B.S.S.2612	£4 14 3	£0 17 3
	"Popular" 2467 single three-heat	60×25	63 W	Self-compensating element	Gold, pink and eau-de-nil	Wool and cotton mixture	Satin binding. Made to B.S.S.2612	£4 18 1	£0 17 11
	"Popular" 2468 double three-heat	60×44	120 W	Self-compensating element	Gold, pink and eau-de-nil	Wool and cotton mixture	Satin binding. Made to B.S.S.2612	£7 3 6	£1 6 3
	1271 Heating pad	16×12	65 W	Thermostatic	Candy striped	Felt and sanforised fabric	Removable cover. Made to B.S.S.1789	£2 8 7	£0 8 11
	1273 Heating pad three-heat	16×12	65 W	Thermostatic	Candy striped	Felt and sanforised fabric	Removable cover. Made to B.S.S.1789	£3 11 5	£0 13 1
"SLEEP CONTENT" APPLIANCES, Radiant Works, 9, South Parade, Huddersfield.	"Sleep Content"	50×25	70 W	Self-compensating element	Peach	Cotton and wool mixture	Triple safety factors to B.S.S.2612	£2 13 3	£0 9 9
	"Sleep Content"	50×38	104 W	Self-compensating element	Peach	Cotton and wool mixture	Triple safety factors to B.S.S.2612	£3 15 5	£0 13 10
STANLEY BROS. ALDERSHOT, LTD., North Lane, Aldershot.	"Cozy"	60×27	110 W (a) and 150 W (b)	Thermostatic, single (a) and three-heat (b)	Peach	Cotton	—	£5 0 0 (a) £6 8 0 (b)	£0 18 1 (a) £1 3 1 (b)
	"Cozy"	50×54	190 W	Three-heat thermostatic	Peach	Cotton	—	£10 0 0	£1 16 1
	"Cozy"	16×12	35 W	Single-heat	Peach	Cotton	—	£1 16 0	£0 6 6
	"Cozy"	16×22	50 W	Single-heat	Peach	Cotton	—	£2 10 0	£0 9 0
	"Cozy"	16×24	75 W	Three-heat	Peach	Cotton	—	£3 12 0	£0 13 0
	"Cumfee"	50×25	65 W	Self-compensating element	Peach	Cotton	—	£2 10 0	£0 9 2
	"Cumfee"	60×27	90 W	Self-compensating element	Peach	Cotton	—	£3 5 0	£0 11 9
	"Cumfee"	50×40	110 W	Self-compensating element	Peach	Cotton	—	£3 14 0	£0 13 4
	"Cumfee" De-Luxe	54×26	70 W	Self-compensating element	Peach	Woollen	—	£2 17 0	£0 10 4
	"Cumfee" De-Luxe	54×44	120 W	Self-compensating element	Peach	Woollen	—	£4 1 0	£0 14 8
SUTCLIFFE & CLARKSON, LTD., Spa Street Works, Burnley, Lancs.	"Double Gem"	53×40	95 W	Three-heat switch	Blue	Rayon/cotton duplex	Made to B.S.S.2612	£4 2 4	£0 14 4
	"Little Gem"	53×25	60 W	On/off switch	Blue	Rayon/cotton duplex	Made to B.S.S.2612	£3 2 0	£0 10 9
	VR.1	53×25	60 W	Illuminated on/off switch	Blue	Wool mixture	Made to B.S.S.2612	£4 11 0	£0 15 10
	VR.2	53×40	95 W	Illuminated on/off switch	Blue	Wool mixture	Made to B.S.S.2612	£6 3 0	£1 1 5
	VR.3	53×40	95 W	Three-heat switch	Blue	Wool mixture	Made to B.S.S.2612	£6 6 6	£1 2 0
	HS.3	57×26	95 W	Three-heat, thermostatic	Pink	Wool mixture	P.V.C. insulated elements	£5 17 0	£1 0 4
	HD.3	57×43	160 W	Three-heat, thermostatic	Pink	Wool mixture	P.V.C. insulated elements	£7 7 6	£1 5 8
	SS	53×25	60 W	Illuminated on/off switch	White	Wool mixture	Made to B.S.S.2612	£3 15 0	£0 13 0
	DS	53×40	95 W	Illuminated on/off switch	White	Wool mixture	Made to B.S.S.2612	£4 19 3	£0 17 3
	D.3	53×40	95 W	Three-heat switch	White	Wool mixture	Made to B.S.S.2612	£5 2 8	£0 17 10
THERMALUX ELECTRICAL PRODUCTS, LTD., 14-16, Hall Street, Halifax. *(continued on next page)*	"Sleepwell"	30×54	65 W	On/off switch	Pink	All wool	Made to B.S.S.2612	£4 4 6	£0 15 3
	DB and DB.2 mattress overlays	54×72	250 W	Thermostatic	Pink, green or blue	Rayon and cotton ticking covers	Separate control each half (DB.2 only)	£14 10 4 (DB) £16 14 6 (DB.2)	£2 12 5 (DB) £3 0 4 (DB.2)

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
THERMALUX ELECTRICAL PRODUCTS, LTD., 14-16, Hall Street, Halifax. *(continued)*	OSB mattress overlay	36×72	180 W	Thermostatic	Pink, green or blue	Rayon and cotton ticking covers	Illuminated D/P switch	£11 0 0	£1 19 8
	J mattress overlay	27×72	125 W	Thermostatic	Pink, green or blue	Rayon and cotton ticking covers	Illuminated D/P switch	£8 2 10	£1 9 5
	M mattress overlay	27×48	85 W	Thermostatic	Pink, green or blue	Rayon and cotton ticking covers	Illuminated D/P switch	£6 0 0	£1 1 8
THERMEGA, LTD., 37, Thurloe Street, London, S.W.7.	"Thermega" pad P.1612/3	16×12	90 W	Three-heat thermostatic	White	Wool/felt cotton	Complete with covers	£3 0 0	£0 10 10
	"Thermega" pad P.2416/3	24×16	110 W	Three-heat thermostatic	White	Wool/felt cotton	Complete with covers	£5 10 0	£0 19 10
	"Thermega" "County" 6030	60×30	92 W	Single-heat non-thermostatic	Apricot	Fibro-mixture	Made to B.S.S.2612	£3 14 0	£0 13 5
	"Thermega" "County" 6048	60×48	145 W	Single-heat non-thermostatic	Apricot	Fibro-mixture	Made to B.S.S.2612	£6 0 0	£1 1 8
	"Thermega" "Duchy" 6048/3	60×48	132 W	Three-heat non-thermostatic	White	Pure wool moth-proofed	Made to B.S.S.2612	£7 7 0	£1 6 7
	"Thermega" 5430/TC	54×30	110 W	Single-heat thermostatic	White	Pure wool moth-proofed	Made to B.S.S.2612	£4 12 0	£0 16 8
THERMOLECTRICS, LTD., Chapel Works, Church Street, Hampton-on-Thames.	"Siesta" SBA and SBA-K	60×30	90 W	Natural heat dissipation	Rose, pastel pink	Mixture	Neon indicator switch. (SBA-K made to B.S.S.2612)	£3 2 0 £3 10 0 (SBA-K)	£0 11 4 £0 12 8 (SBA-K)
	"Siesta" DBA and DBA-K	60×50	135 W	Natural heat dissipation	Rose, pastel pink	Mixture	Neon indicator switch. (DBA-K made to B.S.S.2612)	£5 0 0 £5 10 0 (DBA-K)	£0 18 1 £0 19 10 (DBA-K)
THERMOSET APPLIANCES, LTD., Chapel Works, Failsworth, Manchester.	"New Era"	50×30 (standard) 60×24 (single)	95 W	Single-heat. Variable heat control unit 39/6 extra	Pale green and cream	"Duplex" material (cotton)	Cover 16/- extra. Made to B.S.S.2612	£5 16 0	£1 1 2
	"Cozee" (single)	60×30	75 W	Single-heat. Variable heat control unit 39/6 extra	Pale green	"Duplex" material (cotton)	Cover 18/- extra. Made to B.S.S.2612	£4 0 0	£0 14 7
	"Cozee" (double)	60×50	140 W	Single-heat. Variable heat control unit 39/6 extra	Pale green and cream	"Duplex" material (cotton)	Cover 24/- extra. Made to B.S.S.2612	£6 0 0	£1 1 11
	"Everest" (single)	48×26	58 W	Single-heat. Variable heat control unit 39/6 extra	Pale green	Cotton	Cover 18/- extra. Made to B.S.S.2612	£2 16 0	£0 10 3
	"Everest" (double)	48×44	92 W	Single-heat. Variable heat control unit 39/6 extra	Pale green	Cotton	Cover 22/- extra. Made to B.S.S.2612	£4 1 0	£0 14 10
WARMEX, LTD., 375, Milton Road, Cambridge.	"Warmex" Standard single	50×24	80 W	Self-compensating element, single-heat	Cream	Cotton	Illuminated safety switch	£2 12 4	£0 10 2
	"Warmex" Standard large	50×30	100 W	Self-compensating element, three-heat	Cream	Cotton	Illuminated safety switch	£4 4 3	£0 15 8
	"Warmex" Standard double	50×48	160 W	Self-compensating element, single (a) and three-heat (b)	Cream	Cotton	Illuminated safety switch	£5 4 9 (a) £6 12 3 (b)	£1 0 3 (a) £1 3 9 (b)
	"Warmex" De-Luxe single	50×24	80 W	Thermostatic, single-heat	Cream	Cotton	Illuminated safety switch	£3 4 3	£0 13 3
	"Warmex" De-Luxe large	50×30	100 W	Thermostatic, three-heat	Cream	Cotton	Illuminated safety switch	£4 18 0	£0 18 3
	"Warmex" De-Luxe double	50×48	160 W	Thermostatic, single (a) and three-heat (b)	Cream	Cotton	Illuminated safety switch	£6 7 7 (a) £7 9 3 (b)	£1 6 5 (a) £1 6 6 (b)
	"Warmex" "Nylon" standard	50×24 (single) 50×48 (double)	80 W and 160 W	Self-compensating element, single-heat	White/red	"Nylon" fur fabric	Made to B.S.S.2612	£4 4 7 (single) £8 8 2 (double)	£0 13 11 (single) £1 7 10 (double)
WARRANTY ELECTRICAL PRODUCTS, 210, West End Lane, London, N.W.6.	DBSA (Standard) and DBSA.4 (De-Luxe)	60×50	300 W	Thermostatic and two infinitely variable switches	Cream, pink, sky blue, camel, green	Flannelette	"Magic Brain" switches, washable cover	£16 11 3 (DBSA) £18 16 3 (DBSA.4)	£2 16 3 (DBSA) £3 3 9 (DBSA.4)

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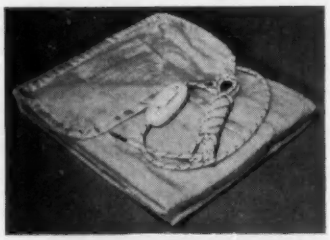

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19. *Wye Valley Hand Weavers blanket*
20. *Thermoset Appliances "Everest" electric blanket*
21. *Windak safety blanket with transformer*

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
WARRANTY ELECTRICAL PRODUCTS CO., 210, West End Lane, London, N.W.6. *(continued)*	DBA (Standard) and DBA.4 (De-Luxe)	50×50	250 W	Thermostatic and two infinitely variable switches	Cream, pink, sky blue, camel, green	Flannelette	"Magic Brain" switches, washable cover	£14 2 6 (DBA) £16 2 6 (DBA.4)	£2 7 6 (DBA) £2 15 0 (DBA.4)
	SA (Standard) and SA.4 (De-Luxe)	60×24	150 W	Thermostatic and infinitely variable switch	Cream, pink, sky blue, camel, green	Flannelette	"Magic Brain" switch, washable cover	£7 7 6 (SA) £8 1 3 (SA.4)	£1 3 0 (SA) £1 8 9 (SA.4)
	A (Standard) and A.4 (De-Luxe)	48×24	125 W	Thermostatic and infinitely variable switch	Cream, pink, sky blue, camel, green	Flannelette	"Magic Brain" switch, washable cover	£6 4 6 (A) £7 5 0 (A.4)	£1 3 0 (A) £1 5 0 (A.4)
	B	24×24	75 W	Thermostatic and infinitely variable switch	Cream, pink, sky blue, camel, green	Flannelette	"Magic Brain" switch, washable cover	£4 5 0	£0 15 0
	C	12×24	60 W	Thermostatic and infinitely variable switch	Cream, pink, sky blue, camel, green	Flannelette	"Magic Brain" switch, washable cover	£3 6 3	£0 11 3
	DBSA.3	60×50	300 W	Thermostatic and two three-heat switches	Cream, pink, sky blue, camel, green	Flannelette	Washable cover	£15 5 0	£2 12 6
	DBA.3	50×50	250 W	Thermostatic and two three-heat switches	Cream, pink, sky blue, camel, green	Flannelette	Washable cover	£13 2 6	£2 5 0
	SA.3	60×24	150 W	Thermostatic and three-heat switch	Cream, pink, sky blue, camel, green	Flannelette	Washable cover	£6 16 4	£1 3 2
	A.3	48×24	125 W	Thermostatic and three-heat switch	Cream, pink, sky blue, camel, green	Flannelette	Washable cover	£5 8 9	£0 18 9
WYE VALLEY HAND WEAVERS, Ross-on-Wye, Herefordshire.	"Wye Valley"	54×31	70 W	Single-heat illuminated safety switch	Cream (a), blue, green or gold (b)	Flannelette cover	Hand woven element. Covers optional, white 20/- striped 22/-	£3 18 3 (a) £4 1 7 (b)	£0 14 8 (a) £0 15 4 (b)
	"Wye Valley"	54×60	140 W	Single-heat illuminated safety switch	Cream (a), blue, green or gold (b)	Flannelette cover	Hand woven element. Cover optional, white 40/-	£7 16 4 (a) £8 2 10 (b)	£1 9 4 (a) £1 10 6 (b)
	"Wye Valley"	50×38	79 W	Single-heat illuminated safety switch	Cream (a), blue, green or gold (b)	Flannelette cover	Hand woven element	£4 9 4 (a) £4 13 6 (b)	£0 16 9 (a) £0 17 6 (b)
	"Wye Valley" De-Luxe	49×38	79 W	Single-heat illuminated safety switch	Peach	Vynide cover	Cover can be sponged down	£5 5 8	£0 19 10
WINDAK, LTD., Woodside, Poynton, Cheshire.	"Windak" single	33×71	72 W	Three-heat illuminated switch via transformer	Yellow edged with green	Pure wool	24 V transformer £6 13 7 extra	£5 6 5	£1 0 0
	"Windak" double	52×71	120 W	Three-heat illuminated switch via transformer	Yellow edged with green	Pure wool	24 V transformer £7 17 1 extra	£7 10 0	£1 8 3

NEW ELECTRICAL EQUIPMENT

Resistance-Capacitance Box

A combined unit incorporating independently adjustable resistance and capacitance ranges is now available from R. E. THOMPSON & Co. (INSTRUMENTS), LTD., Hersham Trading Estate, Walton-on-Thames, Surrey. The standard laboratory instrument incorporates capacitance ranges in 0·1 μF, 0·01 μF and 0·001 μF steps and resistances in 100 kΩ, 10 kΩ, 1 kΩ and 100 Ω steps. Polystyrene capacitors of 1 per cent tolerance are normally used, though silvered mica capacitors are available if required. The capacitors are normally 350 V working and the resistors are $\frac{1}{2}$ W rated. An electrostatic screen connected to the earthing terminal of the box ensures independence of the separate circuits. The price for the standard box is approximately £18.

Transistorised Communication System

A compact transistorised range of communication equipment has been developed by the Marine Department of SIEMENS EDISON SWAN, LTD., Woolwich, London, S.E.18, for situations

Siemens Edison Swan transistorised communication equipment

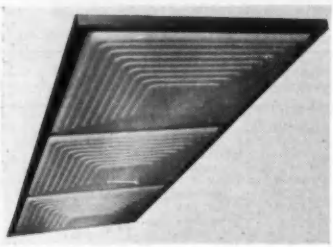
where background noise effects restrict normal speech transmission. A typical system comprises a main station/selector amplifier position which can be linked to loud-hailers or a number of outstation transmitter/loudspeakers for direct two-way speech circuitry. With a 24 V d.c. system, the maximum operating current is 2 A when speech transmission occurs.

Servo Amplifiers

Two types of amplifier have been introduced by R. B. PULLIN & Co., LTD., Phœnix Works, Great West Road, Brentford, Middlesex. The transistor servo amplifier provides control phase power for the size 10 servo motor or motor-generator, having a nominal output of 4 W at an ambient temperature of 55°C. The amplifier is intended for operation on a balanced 400 c/s supply at 26 V, but it may also be powered with 18 V d.c. when it will accept signals in the 150 c/s to 3 kc/s frequency range. In the high power gain magnetic amplifier for use with size 15 servo motors, a polarity reversible d.c. input signal is needed, which is amplified to give a phase reversible a.c. signal to the control phase of the servo motor. The output voltage is in quadrature with the excitation to the amplifier, which has a maximum power output of 5 W at 115 V.

Packaged Ceiling

A small version of the standard "Brite-Glo" packaged ceiling, the "Junior," has been announced by



Courtney, Pope "Junior" packaged ceiling

COURTNEY, POPE (ELECTRICAL), LTD., Amhurst Park Works, Tottenham, London, N.15. The framework measures 6ft by 2ft and a single fluorescent fitting is attached to the ceiling, and the framework is suspended from the fitting by concealed chains. The "Junior" ceiling unit is priced at £9 18s 2d while the standard unit of 6ft by 4ft costs £18 17s 2d.

Negative Phase Sequence Relay

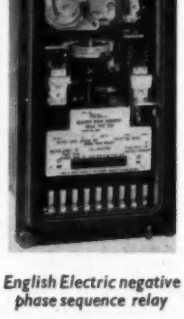
A relay to protect large alternators from damage by rotor eddy currents induced by negative sequence currents flowing in the stator windings under unbalanced load or fault conditions has been announced by the Meter, Relay and Instrument Division of the ENGLISH ELECTRIC CO., LTD., Marconi House, Strand, London, W.C.2. Four negative phase sequence current settings and variable time multiplier settings are provided to give the relay a time/current characteristic approximately matching the alternator heating characteristics. The relay is of the induction disc pattern, fed from a separately mounted negative sequence filter network. A unit with lower sensitivity settings is provided to give an alarm, enabling corrective action to be taken before the tripping unit operates, and a time delay relay prevents unnecessary warning on brief conditions of unbalance. The disc, alarm and time delay units are all mounted in a draw-out case suitable for flush or projection mounting.

Cooling Fluid

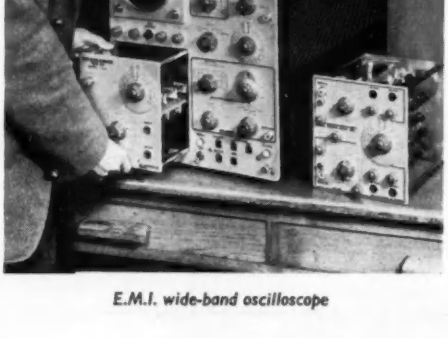
A cooling fluid for use in computers, control systems and other electronic gear capable of withstanding very high temperatures has been developed by MONSANTO CHEMICALS, LTD., Monsanto House, 10-18, Victoria Street, London, S.W.1. The fluid, "Montosil E," has adequate viscosity throughout the temperature range −65 to +400°F and its pour point is below −100°F. It is compatible with the metals commonly used in the construction of electronic equipment, and solders and brazing materials are unaffected by the fluid, though it should not become contaminated by any fluxes used in joining metals.

Wide Band Oscilloscope

The range of products of the Instrument Division of E.M.I. ELECTRONICS, LTD., Hayes, Middlesex, has been extended by the introduction of the W.M.16 wide band oscilloscope incorporating plug-in units for maximum adaptability. The instrument has a rise time of 10 mμsec and a sensitivity of 50 mV/cm. The oscilloscope, which has a bandwidth of d.c. to 40 Mc/s, has been designed to meet the require-



English Electric negative phase sequence relay

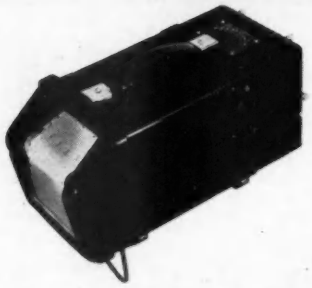


E.M.I. wide-band oscilloscope

ments of overseas markets and will sell at £685 when fitted with a wide band amplifier.

Portable Recording Instrument

A portable multi-range graphic ammeter/voltmeter on which it is possible to record current values in six ranges and voltages in two ranges has recently been introduced by EVERETT EDGCUMBE & Co., LTD., Colindale Works, Colindeep Lane, Hendon, London, N.W.9. Operating in conjunction with a Smith/Hobson split-core current transformer ranges from 10 to 500 A are available, while, when



Everett Edgcumbe recording meter

directly connected to the system, the voltage ranges are 250 and 500 V. The grapher is of the moving-coil rectifier type for use on a.c. systems and has a capsule, non-spillable, inking system giving a record on a 4in chart.

Wire Stripping Machines

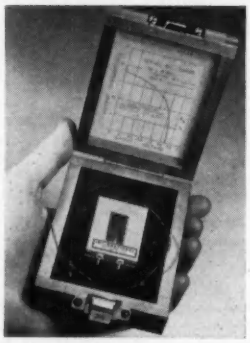
A range of bench type wire stripping machines made by the ERASER COMPANY, INC., Syracuse, New York, is now available for demonstration at their London office, 66, Kingston Road, South Wimbledon, S.W.19. They include the Model D.1 two-wheel stripper employing "Fybrglass" wheels capable of stripping both oil-based and synthetic enamel coverings down to 50 s.w.g. speedily and without breaking or reducing the bare diameter of the wire. Several wires of the same diameter can be stripped simultaneously, including Litz type wires. Model L.2 is a collet and insert type suitable for all classes of single film insulated wires from 8 to 33 s.w.g., stripping to within $\frac{1}{32}$in of the component. A single insertion and withdrawal of the wire is sufficient. Five adjustable inserts cover the range of the diameters.

Model K-7B uses high-speed rotary blades which do not have an edge to them, reliance being placed on the predetermined pressure and the speed of the blades. This machine will handle rubber, plastics, cotton, glass, etc., over enamel, both the outer covering and the enamel being removed in one operation. The spring loaded revolving blades are opened to accept the covered conductor and released on to it by a hand lever or foot-operated pedal. The stripping is carried out on the withdrawal action. The length of strip is determined by an adjustable stop.

Illustrated brochures dealing with this range and modified models for special purposes are available on request.

Standard Solar Cells

To provide accurate radiation measuring standards for checking production silicon solar cells, the INTERNATIONAL RECTIFIER CO. (GREAT BRITAIN), LTD., Hurst Green, Oxted, Surrey, has introduced secondary standard cells. Each cell has a minimum conversion efficiency of 9 per cent and is calibrated to its exact efficiency

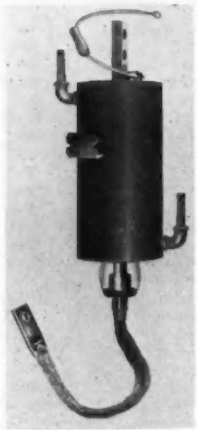


International Rectifier standard solar cell

rating. The cells are mounted in a shock-resistant housing and protected by coated optical glass windows, and a calibration curve showing the efficiency of the unit at certain radiation intensities and specified temperature conditions is mounted permanently in the case. Thermocouple leads are attached for cell temperature measurement.

Mercury-Pool Ignitrons

A range of mercury-pool ignitron tubes announced by MULLARD, LTD., Mullard House, Torrington Place, London, W.C.1, comprises five tubes, all interchangeable with internationally



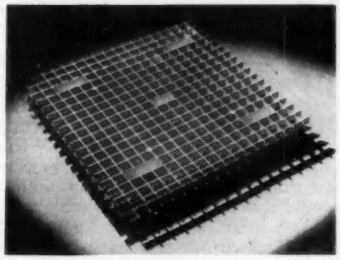
Mullard ignitron

available equivalent types. Four are intended primarily for welding and furnace control circuits and similar applications, while the fifth is designed for power rectification and has limited applications in a.c. control. The tubes are water-cooled and have stainless steel water jackets and cooling sections to avoid corrosion. Thermostats to give control of the water flow or protection against overheating can be fitted.

The type 5551A and 5553B tubes are for use in single- or three-phase welding control circuits. In single-phase circuits the maximum demand rating for two tubes connected in inverse parallel is 600 kVA and 2,400 kVA respectively. The type 5552A is for single-phase welding control circuits, two in inverse parallel having a maximum demand rating of 1,200 kVA, and the type 5822A tube is designed for operation in three-phase frequency changer circuits for welding and furnace control. In this application six tubes can control up to 860 kVA for resistance welding and 240 kW for furnace control. The type 5555 tube, for power rectification, incorporates a "keep-alive" auxiliary anode for operation at low currents or into an inductive load. Six tubes will control up to 500 kW at 600 V.

Cooling Tower Packing

Plastic packing for cooling towers made from either high density polyethylene or high impact polystyrene, both resistant to chemical attack and decay, is announced by HEAD WRIGHTSON PROCESSES, LTD., a subsidiary of



Head Wrightson plastic packing

Head Wrightson & Co., Ltd., 20, Buckingham Gate, London, S.W.1. The "Poly-Grid" packing is moulded in 3ft square grids with 2in sections having $\frac{1}{4}$in splash strips on the top of each rib and 2in spacing between decks.

Silicone Insulating Resin

An experimental silicone resin for flexible electrical insulation has been added to their development range by IMPERIAL CHEMICAL INDUSTRIES, LTD., Imperial Chemical House, Millbank, London, S.W.1. Known as DP.139, it is designed to impregnate glass-cloth at the low temperature range of 100-120°C, a tack-free film being formed after heating for five minutes at 100°C. Treated tape retains its flexibility and electric strength at high temperatures.

Financial Section

STOCKS and SHARES

WITHIN a fortnight or so of polling day, Stock Exchange markets were still showing only mild signs of nervous strain, although reacting perceptibly to reports from the public opinion polls and to any other indication of shifts in the political wind. Industrial share prices were being fairly well maintained on the whole, but the bold front hitherto presented to the election issues by steel shares—accepted as the most sensitive barometer to the investment community's political views—has wavered considerably at times. In the electrical markets the main event has been a satisfactory reception of the A.E.I. interim report, while new issues have again been centres of activity.

A.E.I. Interim Report

Associated Electrical Industries £1 shares were firmly maintained at a little over 60s after publication of the company's interim report covering the first half of this year. At £7¾ million (before depreciation) the group trading profit for this period compares with a figure of just under £7 million for the same half of 1958 (before W.T. Henley's and London Electric Wire had been brought into the group). Compared with the six months to last December the latest profits show a reduction of rather more than a million, but it is recalled that Lord Chandos expected, at the annual meeting held last April, to see better trade during the later part of this year: he mentioned also that the heavy initial costs of starting new plants would become of less importance this year than they were last, and outlined the reorganisation in progress within the group to meet competition more effectively. The second interim dividend is being maintained at 2½ per cent. On last year's total payment of 15 per cent, the shares are on a yield basis of practically 5 per cent.

Price Changes

C. A. Parsons, at 51s 3d, added 1s 3d to the previous week's advance of half-a-crown on the strength of the increase in the interim dividend for the present year. Reyrolle also improved further, to 92s, and G.E.C. continued their advance to 40s. Among the few other changes of any particular significance was a rise in S. Smith & Sons to 18s, while higher prices were quoted also for Vactric, Telegraph Condenser, Hoover, Tube Investments and some others. Heatrae were marked up by a shilling for the second week in succession, reaching 10s. There was a noticeable increase of interest in shares which attract at times the particular attention of American and other overseas investors. E.M.I., which come in that category, rose to 54s 3d, but Philips Lamps dropped 5s 3d to 118s 9d.

Ekco Issue

The 1·3 million new 5s shares offered by way of rights to shareholders of E. K. Cole have been changing hands at a premium of about 5s on the issue price of 16s. Payment of the full amount is due by next Wednesday, 30th September, and the shares will be available free of transfer stamp duty for nearly a month after

Price Changes in

Company or Board	Nom. Value	Middle price 21st Sept.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1959 Highest	1959 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	78		3	3	3 17 0	80½	77½
Brit. Elec. 1974/77	100	75		3	3	4 0 0	77	74½
Brit. Elec. 1976/79	100	79½		3½	3½	4 8 0	80½	77½
Brit. Elec. 1974/79	100	88		4½	4½	4 15 9	91	87½
Overseas Electric Supply								
Calcutta Elec.	£1	19/-		6·8†	7†	11 18 0	19/6	16/-
East African Power	£1	20/6		7½	8	7 16 0	22/3	19/3
Nigerian Elec.	£1	14/6		8	8	11 0 6	15/-	13/-
Perak Hydro-Elec.	£1	15/-		12½	10	13 6 9	15/-	12/3
Electrical Shares								
Aberdare Holdings	5/-	16/6		17½	17½	5 6 0	16/9	15/6
Aerialite	1/-	9/3		51½	54	5 16 9	9/6	7/9
Allen, W. H.	£1	51/3		11	12	4 13 9	51/3	43/-
Allied Insulators	5/-	20/-	+6d	—	20‡	5 0 0	21/6	18/9
Anglo-Portuguese Tel. ...	£1	29/-		9	9	6 4 3	29/6	26/6
Aron Elec. Ord.	£1	56/3		15	15	5 6 9	62/6	55/-
Assoc. Elec. Ord.	£1	60/9	+9d	15	15	4 18 9	63/6	53/9
Automatic Tel. & El. ...	£1	75/-		17	17‡	4 10 9	82/6	71/3
Babcock & Wilcox	£1	48/6	−6d	13¾	13	5 7 3	54/6	45/6
Bakelite	10/-	30/-		15	15	5 0 0	31/3	22/-
Baldwin, H. J.	2/-	2/3	−3d	20	20	—	3/-	2/3
Berry's Electric	5/-	21/3		10	20‡	4 14 0	22/-	7/3
Bowthorpe Holdings	2/-	15/3	+3d	25	27	3 11 0	15/6	11/9
British Elec. Traction: Def. Ord. "A"	5/-	36/6	−1/-	25	35	4 16 0	41/-	35/6
B.I. Callender's	£1	52/6	+6d	12½	13½	5 2 9	56/6	44/9
B.I. Callender's 6% Pref.	£1	20/6		6	6	5 17 0	20/6	19/9
British Thermostat	5/-	23/9	−4/3	30	35	3 13 9*	28/-	18/6
British Vac. Cleaner	5/-	7/9		10	7½*	4 16 9	7/9	4/6
Brook Motors	10/-	51/3		25	24½*	4 14 0	54/3	46/-
Bulgin, A. F.	1/-	10/6		45	50	4 15 3	10/6	6/9
Bulpitts	5/-	17/3		—	15	4 7 0	18/3	10/-
Burco Dean	5/-	16/3	+3d	22½	16*	4 18 6	16/3	12/3
Cable & Wireless: Ord.	5/-	15/9		10	10*	3 3 6	16/-	12/3
4% Loan	100	94½		4	4	4 4 9	95	93
Chloride El. Storage "A" ...	£1	58/3	+9d	17½	20‡	4 11 6*	60/-	43/8
Clarke Chapman	£1	53/9		27½	13¾*	5 2 3	66/3	52/6
Cole, E. K.	5/-	20/9	+6d	17½	20	4 16 6	23/6	17/3
Contactor Switchgear	5/-	15/-		20	14*	4 13 3	15/-	12/-
Cossor, A. C.	5/-	8/-		Nil	5	3 2 6	9/-	6/3
Crabtree	10/-	32/-	+1/9	20	20	6 5 0	32/-	28/-
Crompton Parkinson	5/-	14/-		16	12*	4 5 9	14/3	11/9
Davis & Timmins	5/-	17/-		18	20	5 17 9	17/-	14/6
De La Rue	10/-	49/-	−1/-	17½	20	4 1 9	54/-	30/3
Decca "A"	10/-	38/-		43¾	50	5 5 3*	40/3	33/3
Desoutter	5/-	27/6		32½	21⅞*	3 18 9	27/6	19/-
Dewhurst	2/-	8/-		20	20	5 0 0	8/3	7/3
Dictograph Tel.	2/-	8/-		20	20	5 0 0	8/3	7/-
Dubilier Condenser	1/-	4/6		20	25	5 11 0	5/-	3/3
Duport	5/-	14/3		25	12½*	4 7 9	14/3	10/3
E.M.I.	10/-	53/6	+1/-	15	20*‡	3 14 9	64/6	48/-
Electrical Apparatus	5/-	15/-		12½	14½	4 16 9	15/-	13/-
Electrical Components	5/-	14/9		12½	15	5 1 9	15/9	10/6
Elec. Construction	£1	33/6		8½	9	5 7 6	33/6	27/9
Elliott-Automation	5/-	24/-	+1/6	—	10‡	2 1 9	30/6	16/9
English Electric	£1	43/6	+6d	14	14	4 5 6*	45/-	37/10
English Electric 3½% Pref.	£1	13/-		3½	3½	5 15 6	12/9	12/3
Ericsson Tel.	5/-	22/3	−6d	12†	13†	4 15 6	27/3	22/3
Ever Ready	5/-	24/9	−3d	20	27½‡	3 6 6*	26/-	13/3
Falk Stadelmann	£1	25/-		17½	10*‡	8 0 0	32/9	25/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

that. Proceeds of the issue, which will increase the company's resources by over a million, are to be spent on buildings and plant and in financing the general expansion of business. The new shares rank equally with the old for dividends declared in respect of the current year. Trading is said by the directors to be progressing satisfactorily, and they hope in the normal course of events to be able at least to maintain the present 20 per cent rate of dividend on the larger capital. At the all-in price of 21s, the new shares offer, therefore, a minimum prospective return of 4¾ per cent.

Other Recent Issues

Thorn Electrical Industries new 5s shares became fully paid-up today (Friday). A good demand for the shares raised the premium previously to 10s 9d on the issue price of 25s. Application lists for this company's offer of £3½ million 6 per cent unsecured loan stock 1979/84 at par closed last Wednesday and dealings were expected to begin early next week. The premium on Plessey's new 5s shares remained at about 10s: the first instalment of 10s has now been paid, and the balance of 13s 6d will be due in December. General Electric Company's 6 per cent unsecured loan stock 1979/84, issued at par, maintained a premium of a fraction over 2 points. It will be transferable free of stamp duty until shortly before it becomes paid-up on 22nd October.

Vactric Report

Comparison of the Vactric Company's results for the year ended last March with those of 1957–58 is confused by the effects of the sale of subsidiaries. Excluding these, however, the net trading profit of the group was shown to have been more than doubled, to £581,000. Taking into account the drop in income from the former subsidiary Awley Finance, now sold, and losses arising from the disposal of the Canadian subsidiary, the net profit after tax showed little change, but Mr. W. C. Pegley explained in the report that the dividend was determined by reference to the profits of the group as it is now constituted. Dividends for the year total 37½ per cent (the interim applying to capital before a small scrip issue) and are estimated to be covered some 2¾ times by earnings of the present group. The yield on the 5s ordinary shares at 45s is just under 4¼ per cent. Earlier this year a bid for the shares was rejected on the grounds that it failed to take into account the group's earnings potential.

British Thermostat

In announcing an increase in the interim dividend for the current year from the equivalent of 3¾ to 5 per cent, British Thermostat advised shareholders that the change was being made solely to narrow the difference between the interim and final payments and in no way as an indication that the total would be increased or even maintained. Under more difficult trading conditions, profits for the first six months of the year were stated to have been below those for the corresponding half of last year. In the annual report issued last June, there had been references to a serious decline in the company's aircraft business, the replacement of which by expansion in other directions would take some time, but the latest announcement reversed rather sharply the previously upward trend in the 5s shares, which were marked down by 4s 3d to 23s 9d.

Electrical Investments

Company or Board	Nom. Value	Middle price 21st Sept.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield £ s d	1959 Highest	1959 Lowest
Electrical Shares—continued								
G.E.C.	£1	40/-	+6d	10	10	5 0 0	40/3	31/3
G.E.C. 6½% Pref.	£1	22/-		6½	6½	5 18 3	22/-	20/3
General Cables	5/-	7/9	−6d	24	15	9 13 6	9/3	7/6
Greenwood & Batley	£1	105/-		20	30	5 14 3	105/-	75/-
Hackbridge Holdings	5/-	17/3		20	20	5 16 0	19/3	14/3
Hackbridge & Hewittic	5/-	13/6		20	20	5 11 0*	13/6	10/6
Head Wrightson	5/-	32/6	+6d	17½	20*	3 1 6	32/6	24/3
Heatrae	2/-	10/-	+1/-	20	20	4 0 0	10/-	7/6
Holophane	5/-	17/6		37½	22½*	6 8 6	18/9	14/9
Hoover	5/-	80/-	+1/3	50	60	3 15 0	81/6	55/-
I.C.I.	£1	42/6	+1/6	12	8*	3 15 3	42/6	33/-
Intl. Combustion	5/-	35/-		25	30‡	4 5 9	36/6	29/9
Intl. Computers & T.	£1	65/-		—	8‡	2 9 3	78/9	57/6
Johnson & Phillips	£1	20/6	−6d	5	5	4 17 6	30/6	20/6
Lancashire Dynamo	£1	43/9	+9d	11	12½‡	4 6 0*	43/9	31/6
Laurence Scott	5/-	17/3		15	15	3 15 0*	17/3	14/-
Lister, R. A.	£1	42/-		10	12½	5 19 0	42/-	32/9
Lucas, J.	£1	53/9	+9d	7½	10‡	3 14 6	55/-	43/3
Marconi Marine	£1	42/-		10	10	4 15 3	48/6	40/-
Marryat & Scott	2/-	9/9		37½	22½*	4 12 3	10/-	8/6
Mather & Platt	£1	45/6		15	10‡*	4 14 0	51/6	41/3
Metal Industries	£1	53/9	+1/3	14	14	5 3 9	56/3	39/9
Midland Elec. Mfg.	£1	46/3		12½	10*	4 6 6	46/3	41/6
Morphy-Richards	4/-	27/6	−1/3	20	20	2 18 3	30/6	18/-
Murex	£1	51/3		17½	15	5 17 0	51/3	42/-
Newman Ind.	2/-	3/3		10	10	6 3 0	3/6	2/3
Oldham & Son	1/-	3/-		17½	17½	5 16 9	3/-	2/6
Parsons, C. A.	£1	51/3	+1/3	7½	8½‡	3 3 6	55/9	45/9
Philips' Lamps	Fl.10	118/9	−5/3	14	14	2 3 9	130/-	88/-
Plessey	10/-	34/3	+9d	30	14*‡	4 1 9	37/6	23/6
Pye	5/-	15/-		12½	12½	4 2 3	16/9	13/9
Pyrotenax	5/-	40/-		—	34	4 5 0	40/-	33/9
Reliance Clifton	5/-	24/-		15	15	3 2 6	23/6	17/6
Reyrolle	£1	92/-	+9d	17½	17½	3 16 0	98/-	85/9
Rheostatic	4/-	10/3		12½	12½	4 17 6	10/9	8/3
Richardsons Westgarth	10/-	12/-	−3d	8½	8½	6 19 0	15/3	12/-
Simon-Carves	5/-	29/6		25	25	4 4 9	32/-	28/6
Smith (England), S.	4/-	18/-	+1/3	20	12½*‡	2 15 6	18/-	11/6
Southern Areas	£1	14/-		Nil	Nil	Nil	15/-	10/6
Strand Elec.	5/-	11/9		15	20	8 10 3	11/9	8/6
Sturtevant	5/-	20/-	+2/-	15†	15†	6 3 0	20/-	17/-
Sun Elec.	5/-	16/9		25	25	3 14 9*	16/9	8/3
Switchgear & Cowans	5/-	13/3	−6d	22½	15*	5 13 3	13/9	10/3
T.C.C.	10/-	47/6	+1/3	25	25	5 5 3	47/-	38/-
Telephone Mfg.	5/-	6/3		10	10	8 0 0	6/3	4/9
Telephone Rentals	5/-	16/9		12½	12½*	3 14 9	17/-	11/9
Thompson (John)	5/-	20/6		25	25	6 2 0	25/6	20/-
Thorn Elec.	5/-	35/9	+9d	17½	20	2 16 0	40/-	26/3
Thornycroft	£1	27/-		12½	7½	5 11 0	30/-	20/6
Tube Investments	£1	92/6	+3/9	15	17½	3 15 9	92/6	71/6
Vactric	5/-	45/-	+1/3	25	37½	4 3 3	46/6	26/3
Veritys	5/-	1/6		12½	2½	—	5/-	1/3
Walsall Conduits	4/-	12/9	+3d	22½	22½	4 1 0*	14/2	10/8
Ward & Goldstone	5/-	46/6	+6d	25	30	3 4 6	46/3	30/6
Watford	2/-	10/3	+3d	25	25*	4 17 6	10/-	7/6
Westinghouse	£1	48/3		10	10	4 3 0	48/3	39/6
West, Allen	5/-	12/6	−3d	12½	11½*	4 13 3	14/-	11/9
Wolf Electric	5/-	9/-		10	10	5 11 0	9/3	7/9

REPORTS and DIVIDENDS

Associated Electrical Industries, Ltd., in its statement for the half-year to 30th June last, reports a group trading profit of £7·75 million. This compares with £6·99 million for the corresponding period of 1958, which did not include the Henley Group and the London Electric Wire Co. & Smiths, both of which were acquired subsequently. The trading profit for the second half of 1958 was £8·87 million. After providing £2·74 million for depreciation, the net profit before taxation and before deducting pre-acquisition profits of the new subsidiaries is £5·01 million (against £4·84 million for January-June, 1958, and £6·23 million for July-December, 1958). The total value of output (total invoicing, excluding inter-trading) was £95·6 million (£77·3 million, January-June, 1958, £104·3 million, July-December, 1958), and orders received (mainly for delivery within three years) totalled £84·9 million (£80·2 million and £87·8 million). A second interim dividend of 2½ per cent, making 5 per cent to date, is declared (unchanged). For the year 1958 the total paid on smaller capital was 15 per cent.

Vactric, Ltd.—In his review of the year ended 28th March last, which has been circulated to shareholders, Mr. W. C. Pegley (chairman and managing director) says that whereas the group had the benefit of a profit from the sale of the Awley Finance Co., Ltd., of £163,745 in 1957-58, it received a dividend of only £45,000 during the year 1958-59. With regard to the sale of the Canadian subsidiary, they have had to reserve a further amount of £58,310 in respect of indebtedness which they will not recover. On the other hand they have disposed of the undertaking to a Canadian concern which will continue to purchase their products. They have also been able to bring in a capital surplus over the cost of the shares of £67,225. Further receipts on capital account are anticipated and may amount to a substantial figure. The net trading profit of the group, before tax, for the year under review was more than double the corresponding figure for the preceding year and a record in the company's history. There has been a substantial increase in turnover, but the net profit earned as a percentage of turnover is a modest one. The control equipment and precision tool subsidiaries both contributed their fair quota to the satisfactory result.

Sterling Cable Co., Ltd.—The accounts for the year ended 31st March last show a group trading profit of £188,271, as compared with £184,492 for the preceding year, and after meeting all charges, including £41,317 for taxation, there is a net balance of £64,027 (against £50,674). It is proposed to pay a final dividend of 5½ per cent on capital as increased in March last by £155,000, making 13 per cent for the year. For the previous year the total, which included a bonus of 5 per cent, was 15 per cent.

In his accompanying statement, Mr. J. S. Clark (chairman and managing director) says that price competition intensified during the year under review, and on the home front competition for the business of the big users is extreme. As cable is purchased to a published standard quality, price is the deciding factor. The smaller purchaser is not anxious that his sources of supply should be reduced to a limited number of manufacturers, and there is no doubt that the independent members of the electrical contracting industry are strengthening their own position by supporting individual manufacturing concerns.

On the export front they have felt the effect of the considerable number of new plants that have been established in various countries of the world. These new concerns confine their attention to the simpler types of cable, and it has so far been possible for the company to maintain a healthy export turnover in the more specialised types. So far as the current year is concerned, they still have a healthy order book and their turnover is being maintained.

The British Thermostat Co., Ltd., in declaring an interim dividend of 5 per cent (against 7½ per cent) on capital doubled by a scrip issue, emphasises that the increase is solely in order to bring the interim and final dividends more into line and must not be regarded as an indication that the current year's total will be increased or even maintained. The directors state that the trading conditions in the aircraft industry are becoming difficult and the profits of the group for the half-year are less than those for the corresponding period last year.

James Howden & Co., Ltd., report group profits for the year to 30th April last of £792,190, as compared with £905,039 for 1957-58, to which is added £96,281 brought in, making £888,471. Taxation absorbs £445,480, and the net balance is £442,991 (against £532,602). General reserve receives £150,000 and it is proposed to pay a final dividend of 20 per cent, maintaining the distribution for the year at 25 per cent. The balance carried forward is £189,248.

Herman Smith, Ltd., has signed contracts to acquire the whole of the issued share capital in Taylor & Wilson, Ltd., Taywil Works, Accrington, Lancs., which supplies the "Taywil" range of domestic products including electric boilers, refrigerators, etc. The consideration for the Taylor & Wilson share capital is £45,890 in cash and the allotment of 44,000 2s ordinary shares in Herman Smith, Ltd. Herman Smith, Ltd., has also acquired for cash debentures outstanding amounting to £9,000.

Bennis Combustion, Ltd.—The group trading profit for the year ended 30th April last is £23,671, as compared with £7,468 for the preceding year, and the group net profit, after providing £3,300 for taxation, is £908 (against a loss of £15,559). No ordinary dividend is proposed for the year. In the previous year an interim dividend of 2½ per cent was paid, but there was no final payment. The balance carried forward is £49,037 (against £52,262 brought in).

Murex Welding Processes, Ltd., has purchased the whole of the issued shares of Donald Ross & Partners, Ltd., Crawley, Sussex, specialists in the design and manufacture of mechanical aids to production and in particular the "Twinner" positioners for hand and automatic welding. Donald Ross & Partners will continue to operate as in the past under the same name and the same management.

Eveready South Africa, Ltd.—The net profit for the year ended 30th June last was £190,047, as compared with £129,552 for 1957-58. It is proposed to pay a final dividend of 13¼ per cent, making 18¼ per cent for the year. For the previous year the total was 20 per cent, but the interim dividend was paid on smaller capital.

A. H. Hunt (Capacitors), Ltd., has announced an interim dividend of 5 per cent (against 3¾ per cent). The increase does not imply an increased total for the year.

Thomas Bolton & Sons, Ltd., have announced an interim dividend of 2½ per cent (unchanged).

Blaw Knox, Ltd., has declared an interim dividend of 10 per cent (unchanged).

Liquidations

Kingston Electronics, Ltd., radio and electrical engineers, 27, Ely Place, London, E.C.1.—Winding up. Liquidator, Mr. A. W. Hunter, Walter House, 418-422, Strand, London, W.C.2, appointed 31st August.

Arthur Marriott, Ltd., electrical and radio engineers, 9, High Street, Loughborough, Leics.—Winding up voluntarily. Joint liquidators, Mr. C. E. Fletcher, 25, Friar Lane, Leicester, and Mr. R. A. Haigh, Court Chambers, Friar Lane, Leicester. Particulars of claims to Mr. R. A. Haigh by 23rd November.

Bankruptcies

D. Fryer, 11, Welburn Road, Stockton-on-Tees, company director, lately carrying on business as a radio and television and electrical dealer and repairer at 34, Brunswick Street, Stockton-on-Tees.—Trustee, Mr. C. H. W. Sansom, Components House, Zetland Road, Middlesbrough, appointed 10th September.

L. J. Wotton, 76, Babbacombe Road, Torquay, radio and electrical engineer.—Last day for receiving proofs for dividend 29th September. Trustee, Mr. J. E. Ellis, 50, The Terrace, Torquay.

W. O. Curry, 17, Kent Close, Bexhill-on-Sea, previously carrying on business as an electrical contractor at 1, Tynevale Terrace, Lemington-on-Tyne, now electrician.—Second dividend of 1s 6d in the £, payable on and after 28th September at the offices of Bradley-Hole, Croydon & Co., 7, Old Steine, Brighton, 1.

GENERATION and DEVELOPMENT

Electricity Output

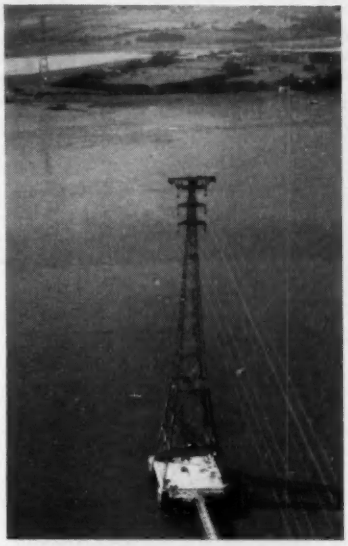
The Ministry of Power's monthly statement shows that 6,846 million kWh was generated by the C.E.G.B. and the two Scottish Boards in August, an increase of 7·1 per cent over the total for the corresponding month of last year; this compares with an average increase of 5·6 per cent in the preceding seven months. A point of interest is that coal consumption, which had been running at a lower level than last year, was 4 per cent higher in August.

In the Electricity Council's monthly statistics the national figures show an increase over August, 1958, of 8·4 per cent; when corrected for weather and working conditions, this is equivalent to 10·8 per cent. While the Southern Board maintained its lead with an increase of 10·3 per cent for the year ended 31st August, the Yorkshire Board recorded the highest rate of expansion last month (14·8 per cent) followed by the North Eastern Board (11·7 per cent) and the Midlands Board (11 per cent).

A separate analysis of generation by industry indicates that with two exceptions electricity production was substantially higher in the four weeks ended 29th August than a year ago. The percentage changes were as follows:—Chemical industry (excluding nuclear power stations) +12·9; iron and steel −1·1; engineering +23·0; textiles, leather and clothing +27·6; food, drink and tobacco −4·7; paper +14·9; and other industries +14·5. The nuclear power stations of the U.K.A.E.A. produced 94·8 million kWh, making a total of 690·7 million kWh in the first 34 weeks of this year compared with 243·5 million in the corresponding period of 1958.

Severn-Wye Crossing

The Rivers Severn and Wye are now spanned by overhead electric conductors and the crossing is believed to rank fifth or sixth largest in the world. It forms part of a 275 kV supergrid line connecting Uskmouth power station in Wales with Melksham substation in England. To reduce the length of this line as much as possible, it was planned to cross the rivers at their confluence near Chepstow. This was an ambitious proposal because the river at this point is over a mile wide and the lines had to be at least 135ft above high water to give adequate clearance to shipping. The contracts for the scheme were awarded to the J. L. Eve Construction Co., Ltd.



Transmission towers nearly 500ft high are used for crossing the Rivers Severn and Wye at their confluence near Chepstow

The main crossing towers are just under 500ft high and each weighs 200 tons. One stands on a concrete island sited just above low water level: it was placed there so that the profile of the crossing would match the suspension ropes of the proposed road bridge.

The seven conductors, each 12,000ft long and weighing 23 tons, are made of aluminium and steel wires and have a breaking strength of 100 tons. They were put into place without ever touching the ground or the water, and without delaying any river traffic.

Power Plant Additions

During August Marchwood power station (Southern Division, Central Electricity Generating Board) reached its ultimate capacity of 480 MW with the installation of the eighth 60 MW set and 550 klb/hr boiler (English Electric and John Thompson, respectively). The first set was commissioned in December, 1955. Other plant brought into service by the C.E.G.B. last month included a 120 MW Metropolitan-Vickers set and 860 klb/hr International Combustion boiler at Agecroft "C" (North West, Merseyside and North Wales Division) and a 300 klb/hr Mitchell boiler at Portishead "B" (South Western Division). There were no additions to the plant of the South of Scotland Electricity Board and the North of Scotland Hydro-Electric Board.

ELECTRICITY GENERATED AND SENT OUT FOR PUBLIC SUPPLY

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity G.B. ...	2,695	72	301·3	6,334	2	6,339	5,938	26,342
North of Scotland H.E.B.	10	—	1·1	20	108	133	131	1,030
South of Scotland E.B. ...	192	2	0·3	368	6	374	352	1,651
Total for August, 1959 ...	2,897	74	302·7	6,722	116	6,846*	6,421	29,023
Corres. total for August, 1958 ...	2,786	58	245·2	6,248	138	6,395	6,002	27,008
Inc. or dec., per cent ...	+4·0	+27·0	+23·4	+7·6	−15·7	+7·1	+7·0	+7·5
Total to date (8 months), 1959 ...	29,084	763	2,620·2	65,606	1,275	66,966	62,990	
Total for corres. 8 months of 1958	29,782	639	1,308·4	61,871	1,341	63,316	59,547	
Inc. or dec., per cent ...	−2·3	+19·4	+100·3	+6·0	−4·9	+5·8	+5·8	

*The total figure includes generation by other methods amounting to 8 million kWh.

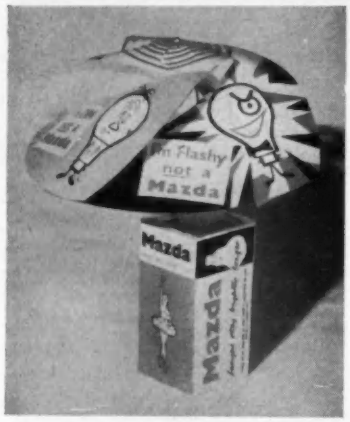
ELECTRICITY SENT OUT BY BOARDS FOR THEIR CONSUMERS

Board	Totals for August (million kWh)			Twelve Months Totals Ended 31st August (million kWh)		
	1958	1959	Inc. or Dec. %	1958	1959	Inc. or Dec. %
London	443·4	444·2	+ 0·2	7,569·9	7,877·5	+ 4·1
South Eastern	334·2	345·0	+ 3·3	5,056·5	5,395·4	+ 6·7
Southern	422·1	462·1	+ 9·5	6,366·0	7,019·1	+10·3
South Western	223·7	236·0	+ 5·5	3,097·0	3,315·1	+ 7·0
Eastern	512·8	549·7	+ 7·2	8,057·2	8,564·0	+ 6·3
East Midlands*	435·5	473·3	+ 8·7	6,713·6	7,147·2	+ 6·5
Midlands*	521·5	578·8	+11·0	8,695·5	9,329·9	+ 7·3
South Wales*	352·0	371·1	+ 5·4	4,987·8	5,252·0	+ 5·3
Merseyside and North Wales* ...	364·2	392·5	+ 7·8	5,261·8	5,548·1	+ 5·4
Yorkshire*	536·2	615·7	+14·8	8,607·3	8,933·3	+ 3·8
North Eastern*	329·1	367·7	+11·7	5,039·9	5,253·4	+ 4·2
North Western*	606·7	647·7	+ 6·8	8,916·1	9,186·5	+ 3·0
Total all Area Boards	5,081·4	5,483·8	+ 7·9	78,368·6	82,821·5	+ 5·7
Direct Supplies by C.E.G.B. ...	248·9	292·9	+17·7	2,821·7	3,236·0	+14·7
Grand Total	5,330·3	5,776·7	+ 8·4	81,190·3	86,057·5	+ 6·0
Mainly Industrial Areas*	3,145·2	3,446·8	+ 9·6	48,222·0	50,650·4	+ 5·0
Mainly Non-Industrial Areas* ...	1,936·2	2,037·0	+ 5·2	30,146·6	32,171·1	+ 6·7
South of Scotland E.B.	431·8	472·3	+ 9·4	6,491·6	6,944·7	+ 7·0
North of Scotland H.E.B. ...	99·0	103·2	+ 4·3	1,511·9	1,576·4	+ 4·3

* Those in which industrial consumers took over 50% of the total sales in the preceding financial year.

LAMP SALES PROMOTION

A NUMBER of attractive sales aids are available for its "Mazda" lamp autumn publicity from the A.E.I. Lamp & Lighting Co., Ltd. Two new films featuring "Dim" and "Flashy," the two knock-about lamps, and "Mazda," the hero of the TV series, will be shown on all stations from 3rd October. They will alternate with the two films which appeared last year. The films, which are of 30-second duration and have an easily memorised jingle, will also be seen on two new stations, Anglia and Ulster, which open at the end of October.



A "Mazda" rotary display which revolves by the heat of the lamp

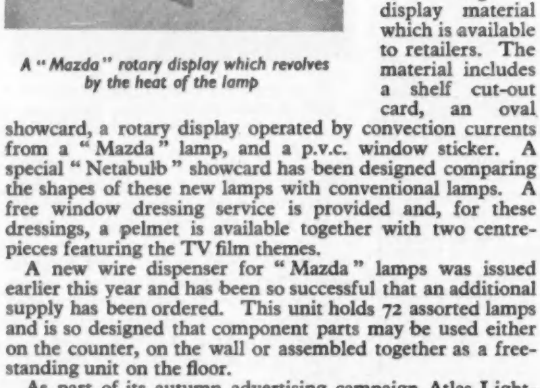
The TV characters are also used in a range of display material which is available to retailers. The material includes a shelf cut-out card, an oval showcard, a rotary display operated by convection currents from a "Mazda" lamp, and a p.v.c. window sticker. A special "Netabulb" showcard has been designed comparing the shapes of these new lamps with conventional lamps. A free window dressing service is provided and, for these dressings, a pelmet is available together with two centre-pieces featuring the TV film themes.

A new wire dispenser for "Mazda" lamps was issued earlier this year and has been so successful that an additional supply has been ordered. This unit holds 72 assorted lamps and is so designed that component parts may be used either on the counter, on the wall or assembled together as a free-standing unit on the floor.

As part of its autumn advertising campaign Atlas Lighting, Ltd., has launched a nation-wide commercial television campaign. The theme of these TV spots will be "Atlas Lighting Everywhere"—showing both traders and public that good lighting helps to make life easier at work, in the home, at play, at school, indoors and outdoors. Full support to this campaign will be given by bus sides, posters, escalator panels and a variety of point-of-sale items for dealers' use. In addition to a comprehensive range of general and technical literature, a completely new edition of the Atlas lighting catalogue is being printed and will shortly be available for distribution. Further backing will be given by trade and technical Press advertising. "De Luxe Natural" tubes, Atlas "Atlantic" fittings, "Modulite" trunking, "Domino" display lighting fittings, photographic and photoflash lamps and street lighting lanterns, are all being advertised in special announcements. Among point-of-sale items, a colourful new self-service dispenser unit is of special interest. This unit is supplied with colour coded price cards and will hold up to 150 lamps. A new animated showcard has been designed using the Atlas "Clown" theme—in which a moving coloured disc working from a small battery gives an illusion of a flashing sign. Designed to tie-up with the television advertising, another showcard illustrates the opening scene of the TV announcement—a night sky superimposed in "Dayglo" lettering with the slogan "Atlas Lighting Everywhere." A new series of window display cards and pelmets will be available, and there is a specially attractive swinging sign available for dealers' premises.

The company has issued a new price list amended to give full details of the price changes following the recent announcement of reductions in the prices of its g.l.s. lamps, and a discount and purchase tax guide for groups I and IX tungsten filament and discharge lamps and fluorescent tubes is also available.

A swinging sign for dealers of Atlas lamps



Immersion Heaters

WHEN the first edition of B.S. 1556 entitled "Electric Immersion Heaters for Domestic Hot Water Supply" was published in 1949 most thermostatic immersion heaters had thermostats complying with B.S. 1555, "Thermostats for Electrically-Heated Domestic Hot Water Supply (A.C. Only)." Since then, immersion heaters with thermostats of various types and differing in many respects from those in B.S. 1555 have been introduced, and this has led to the revision of B.S. 1556, which now includes performance requirements for thermostatic immersion heaters. These requirements will ensure that an immersion heater installation will provide a satisfactory supply of hot water for domestic purposes even though the thermostats themselves are not in accordance with B.S. 1555.

The number of the revised Standard is one of six marks required to appear on all immersion heaters complying with this new publication. In addition, the requirements in the 1949 edition dealing with electrical safety have been amended, bringing them into line with modern practice. Copies of B.S. 1556 : 1959 may be obtained from the British Standards Institution, 2, Park Street, W.1, price 5s.

Plastics Behaviour

THE 11th report on trials arranged by the Ministry of Supply and the British Plastics Federation as part of a programme to determine the behaviour of plastics under tropical conditions has been published by H.M. Stationery Office, price 5s. This report deals with the effect of tropical exposure on the properties of both plasticised and unplasticised polymethyl methacrylate. The test methods and the results obtained from examinations of dimensional changes, impact and tensile strength, distortion and transparency are detailed. Previous reports in the series have dealt with expanded plastics, polythene, aminoplastic mouldings, phenolic mouldings, nylon monofilaments, an optical grade of polystyrene, celluloid and cellulose nitrate compositions, asbestos filled phenolic resin, phenolic resin bonded paper tube and synthetic resin bonded laminated sheet.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1953

22230. British Transport Commission.—Automatic train control. 22nd December, 1955. (818751.)

1954

23737. Simplex Electric Co., Ltd.—Means for controlling the power dissipation in electric heaters. 16th August, 1955. (818371.)

25283. Mitchell, F. G.—Cooling towers. 18th August, 1955. (818053.)

32250. Reyrolle & Co., Ltd., A.—Electromagnetic relays. 7th November, 1955. (818172.)

35070. English Electric Co., Ltd.—Gas-blast circuit-breakers. 2nd December, 1955. (818521.)

37792. English Electric Co., Ltd.—Control apparatus for electric motors. 30th December, 1955. (818231.)

1955

1506. Dewhurst & Partner, Ltd., Dewhurst, M., Ward, A. J. C., and Mins, G. E.—Devices for affording protection to electric circuits. 11th January, 1956. (818561.)

4682. Evershed & Vignoles, Ltd.—Earth resistance measuring equipment. 8th February, 1956. (818482.)

13774. Metropolitan-Vickers Electrical Co., Ltd.—High frequency radio apparatus. 10th May, 1956. (818670.)

17547. English Electric Co., Ltd.—Brush holders and brush holder assemblies for dynamo-electric machines. 15th June, 1956. (818292.)

21675. Elektrophysikalische Anstalt B. Berghaus.—Construction of leading-in connections for glow discharge vessels. 27th July, 1955. (818413.)

24435. Plessey Co., Ltd.—Electromagnetic devices. 31st August, 1956. (818222.)

24495. General Electric Co., Ltd.—Lighting fittings. 22nd August, 1956. (818401.)

24723. Philips Electrical Industries, Ltd.—Electromagnetic deflection systems. 29th August, 1955. (818563.)

25445. Bendix Aviation Corporation.—Magnetic amplifier systems. 5th September, 1955. (818402.)

27239. Metropolitan-Vickers Electrical Co., Ltd.—Magnetic amplifiers. 19th December, 1956. (818057.)

27744. Philips Electrical Industries, Ltd.—Permanent magnets. 29th September, 1955. (818293.)

29725. Pirelli-General Cable Works, Ltd.—Manufacture of tubing and tubular sheathing. 2nd October, 1956. (818635.)

29891. Metropolitan-Vickers Electrical Co., Ltd.—Electrical heating apparatus. 18th January, 1957. (818754.)

30449. Electric & Musical Industries, Ltd.—Sound recording systems. 22nd October, 1956. (818585.)

30515. Telephone Manufacturing Co., Ltd.—Connector and circuit arrangement for automatic telecommunication exchange system. 15th October, 1956. (818491.)

31012. Telefunken G.m.b.H.—Method for the production of semiconductor bodies. 31st October, 1955. (818564.)

32380. Säurefabrik Schweizerhall.—Apparatus for transmitting electric current to carbon-containing and other conductive loose material for electric heating. 11th November, 1955. (818621.)

33046. Clevite Corporation.—Ferroelectric ceramic compositions. 18th November, 1955. (818710.)

33772. Siemens-Schuckertwerke A.G.—Semiconductor devices. 24th November, 1955. (818065.)

34209. Carr Fastener Co., Ltd.—Holders for electric lamp bulbs, thermionic valves or other electrical devices having projecting terminal prongs and contacts for such holders. 25th October, 1956. (818154.)

34989. General Electric Co.—Electrical insulating structures. 6th December, 1955. (818038.)

35764. Soc. Nouvelle de l'Outillage R.B.V. et de la Radio-Industrie.—Infra-red sensitive luminescent materials. 13th December, 1955. (818069.)

36917. Igranic Electric Co., Ltd.—Feedback speed regulating systems for electric motors. 23rd December, 1955. (818071.)

1956

988. Murphy, F. M.—Electrical circuit testing instrument. 11th January, 1956. (818216.)

4079. Telefunken G.m.b.H.—Means for tuning oscillatory circuits. 9th February, 1956. (818173.)

4908. Bulova Watch Co., Inc.—Electric timepieces. 16th February, 1956. (818678.)

6829. International Business Machines Corporation.—Electric digital data storage unit. 5th March, 1956. (818145.)

7201. Radio Heaters, Ltd.—High frequency dielectric heating equipment. 6th March, 1957. (818146.)

7734. General Electric Co., Ltd.—Semiconductor devices. 26th February, 1957. (818464.)

7986. General Electric Co.—Infra-red lamp device. 14th March, 1956. (818075.)

7992. Metropolitan-Vickers Electrical Co., Ltd.—Manufacture of printed electrical circuits or components. 1st March, 1957. (818178.)

8257. Decca Record Co., Ltd.—Cathode-ray tube deflection circuits. 10th October, 1956. (Cognate application 8361/56, 12th October, 1955. Divided out of 818476.) (818477.)

8896. Dubilier, W., Dubilier, F., Dubilier, jun., W., and Dubilier, M. H. (trading as Radio Patents Co.).—Electrical measuring apparatus incorporating automatic range selection. 21st March, 1956. (818147.)

9172. General Electric Co., Ltd.—Manufacture of thermionic cathodes. 29th May, 1957. (818051.) 9173. Cathode-ray tubes. 29th May, 1957. (818052.)

9543. Metropolitan-Vickers Electrical Co., Ltd.—Vapour phase chromatography. 15th March, 1957. (818703.)

10332. Siemens & Halske A.G.—Transmitters for a.c. telegraphy. 4th April, 1956. (818180.)

11414. Dirks, G.—Storage of digital electric signals. 15th July, 1957. (Cognate application 11415, 14th April, 1956.) (818235.)

12141. Western Electric Co., Inc.—Silicon rectifiers and methods of manufacturing silicon elements therefor. 20th April, 1956. (818419.)

13454. Brogan, P. J.—Electromagnetic control mechanism. 25th April, 1957. (818226.)

14988. Simms Motor Units, Ltd.—Coupling means for starter motors. 13th August, 1957. (818595.)

15393. General Motors Corporation.—Electrical oscillation generators employing transistors. 17th May, 1956. (818183.)

15502. United Kingdom Atomic Energy Authority, and Metropolitan-Vickers Electrical Co., Ltd.—Winch apparatus especially for use in nuclear reactors. 3rd May, 1957. (817999.)

16865. General Electric Co.—Magnetic amplifiers. 31st May, 1956. (818405.)

20227. British Thermostat Co., Ltd.—Electric adaptors for use with thermostatic switching devices. 21st June, 1957. (818682.)

21092. General Electric Co., Ltd.—Fastening arrangements, more particularly for lighting fittings. 19th June, 1957. (818307.)

22909. British Central Electrical Co., Ltd.—Electrical fittings embodying spring gripping devices. 8th July, 1957. (818001.)

23160. Compagnie Générale d'Electro-Ceramiques.—Methods of metallising ceramic materials. 26th July, 1956. (818640.)

23741. Mullard Radio Valve Co., Ltd.—Circuit arrangements for deriving phase-displaced voltage for use with cold cathode counter tubes. 1st August, 1956. (818528.)

24294. Woodbridge, A. T.—Interfitting electric socket connecting members. 8th August, 1957. (818683.)

24554. Siemens-Schuckertwerke A.G.—Apparatus for pulling crystals from melts of compounds having readily volatile components. 10th August, 1956. (818757.)

24971. General Electric Co.—Temperature compensated voltage regulators. 15th August, 1956. (818237.)

25044. Burndy Corporation.—Electrical pin connectors. 16th August, 1956. (818006.)

28114. Brush Electrical Engineering Co., Ltd.—Circuit-breaker equipment. 5th September, 1957. (818496.)

29911. Simplex Electric Co., Ltd.—Means for controlling the power dissipation in electric heaters. 1st October, 1956. (Divided out of 818371.) (818372.)

32600. Austinlite, Ltd.—A.c. electrical generating sets. 8th October, 1957. (818570.)

32607. Sylvania Electric Products, Inc.—Electric discharge lamp. 25th October, 1956. (818423.)

33106. Leece-Neville Co.—Alternator-rectifier electrical generating system. 30th October, 1956. (818600.)

34198. Landis & Gyr A.G.—Measuring apparatus, more especially for electric devices for testing flue gas. 8th November, 1956. (818761.)

34486. Chamberlain & Hookham, Ltd., Deacon, L. O., and Lewis, H. S.—Electrical energy measuring instruments. 7th November, 1957. (818409.)

34841. Tuck, K. E.—Electronic organs. 11th November, 1957. (818096.)

35638. Brush Electrical Engineering Co., Ltd.—Carbon block resistors. 18th November, 1957. (818424.)

37306. Compagnie Industrielle des Telephones.—Rotary switch. 6th December, 1956. (818624.)

38158. Automatic Telephone & Electric Co., Ltd.—Telephone systems. 2nd December, 1957. (818098.)

38285. Standard Telephones & Cables, Ltd.—Circuit arrangement for synchronising a generator. 14th December, 1956. (818601.)

1957

1000. Marconi's Wireless Telegraph Co., Ltd.—Noise reduction in continuous wave doppler radar systems. 10th January, 1957. (818643.)

1161. Metropolitan-Vickers Electrical Co., Ltd.—Overspeed protection devices. 19th December, 1957. (818309.)

1573. United Kingdom Atomic Energy Authority.—Nuclear reactors. 6th January, 1958. (818193.)

1752. Revo Electric Co., Ltd.—Suspension means for tubular fluorescent lighting fittings. 14th January, 1958. (818194.)

[*Continued overleaf*

NEW PATENTS *(continued)*

2057. Walsall Conduits, Ltd.—Electric switches and indicators therefor. 14th January, 1958. (818762.)

2546. Pfister, M. C.—Thermo-electronic control systems. 24th January, 1957. (818763.)

3524. United Kingdom Atomic Energy Authority.—Integrating circuits. 28th January, 1958. (818104.)

3553. Rizzieri, I.—Socket and plug connectors for electric circuits. 1st February, 1957. (818286.)

4420. Consolidated Electronics Industries Corporation.—Synchronous motors. 8th February, 1957. (818731.)

5902. English Electric Co., Ltd.—Fuse-gear contacts. 14th February, 1958. (818198.)

5903. Unior, A. S.—Electric welding apparatus. 21st February, 1957. (818733.)

6001. Revo Electric Co., Ltd.—Means for mounting indicator lamps. 5th February, 1958. (818199.)

6272. General Electric Co., Ltd.—Cathode-ray tubes. 25th February, 1958. (818106.)

6639. Technical Ceramics, Ltd.—Ultrasonic soldering iron. 27th February, 1957. (818428.)

7768. Compagnie Française Thomson-Houston.—Electrically operated steam irons. 8th March, 1957. (817983.)

7801. General Electric Co., Ltd.—Electrical control circuit arrangements for operation from an a.c. supply. 30th January, 1958. (817984.)

9466. Western Electric Co., Inc.—Electric signal circuits employing magnetic cores. 22nd March, 1957. (817985.)

10093. English Electric Co., Ltd.—Mass-actuated electric switching devices. 21st March, 1958. (817986.)

11887. Raibourn, P.—Television in natural colours. 11th April, 1957. (818626.)

13033. General Electric Co.—Extracting of tungsten compounds from tungsten ores. 24th April, 1957. (818117.)

14156. Westinghouse Electric International Co.—Control systems for elevators. 3rd May, 1957. (817989.)

14248. Standard Telephones & Cables, Ltd.—Bi-stable circuit. 3rd May, 1957. (818118.)

16958. Merck A.G., E.—Electrolytic production of perchloric acid. 28th May, 1957. (818335.)

17014. Compagnie Générale de Télégraphie sans Fil.—Insulation to metal seals with a high melting point. 29th May, 1957. (818202.)

18853. Western Electric Co., Inc.—Arc welding circuits. 14th June, 1957. (818510.)

21720. Souriau & Cie.—Multi-element electrical plug and socket connectors. 9th July, 1957. (818767.)

21830. Metrawatt A.G.—Electronic detecting appliances. 10th July, 1957. (818740.)

22595. Singelmann, W.—Electric cooking stoves. 17th July, 1957. (818696.)

22926. Western Electric Co., Inc.—Frequency selective wave coupling systems. 19th July, 1957. (818122.)

23637. I.-T.-E. Circuit-Breaker Co.—Cooling of electric busbars. 25th July, 1957. (818029.)

23753. Philips Electrical Industries, Ltd.—Transistor circuits. 26th July, 1957. (818768.)

25327. Libbey-Owens-Ford Glass Co.—Making connections to an electro-conductive film. 12th August, 1957. (818741.)

25665. British Thomson-Houston Co., Ltd.—Dynamo-electric machines. 24th December, 1957. (818441.)

26566. Uher, E.—Electromagnetic switching relays. 22nd August, 1957. (818577.)

26960. Allmänna Svenska Elektriska A.B.—Submerged electric arc welding. 27th August, 1957. (818558.)

27707. Morane, R.—Cable terminals for batteries. 3rd September, 1957. (818030.)

28913. Standard Telephones & Cables, Ltd.—Balancing hybrid connections. 13th September, 1957. (818124.)

29488. Westinghouse Electric International Co.—Dynamo-electric machines. 19th September, 1957. (818443.)

30192. Allmänna Svenska Elektriska A.B.—Polyphase stirring winding for melting furnaces and the like. 26th September, 1957. (Addition to 721124.) (818658.)

30330. Standard Telephones & Cables, Ltd.—Grid structure for electronic discharge tubes. 27th September, 1957. (818355.)

31899. A.G. für Unternehmungen der Eisen- und Stahlindustrie.—Charging device for an accumulator particularly for train lighting. 11th October, 1957. (818168.)

35514. Telefonaktiebolaget L. M. Ericsson.—Device for suppressing undesired oscillations in a.c. circuits. 14th November, 1957. (818745.)

35957. Standard Telephones & Cables, Ltd.—Production of printed circuits. 19th November, 1957. (818129.)

1958

717. Allmänna Svenska Elektriska A.B.—Construction of the cover of a heterogeneous nuclear reactor. 8th January, 1958. (Addition to 797485.) (818667.)

4290. Bendix Aviation Corporation.—Electrical wiring harness. 10th February, 1958. (818297.)

4909. Rosenthal-Isolatoren G.m.b.H.—Glazed electric resistors and method of producing them. 14th February, 1958. (818370.)

9537. General Motors Corporation.—Starter control devices for split-phase electric motors. 25th March, 1958. (818580.)

1959

3999. Metropolitan-Vickers Electrical Co., Ltd.—Electric control circuits. 15th March, 1957. (Divided out of 818703.) (818704.)

CATALOGUES AND LISTS

CONTROL GEAR.—Three leaflets covering a.c. and d.c. contactors and side and front operated isolators.—**G.W.B. Furnaces, Ltd.,** Dibdale Works, Dudley, Worcs.

Leaflet (232) dealing with draw-out centralised motor starting equipment.—**Laurence, Scott & Electromotors, Ltd.,** Norwich.

CONVEYORS.—Illustrated brochure (307) dealing with electrically powered vibrating conveyors for handling a wide variety of bulk materials.—**Acme Conveyors, Ltd.,** 1, Bradford Street, Walsall, Staffs.

FLOOR MAINTENANCE.—Illustrated leaflet on the "Turmix" industrial floor maintenance machine.—**Turmix,** Floor Maintenance Division, 61-63, St. John Street, London, E.C.1.

GAS GENERATORS.—Brochure describing nitrogen generators including plant for producing super-purity grade nitrogen as used in the electronic industry.—**Birlec, Ltd.,** Erdington, Birmingham, 24.

INSTRUMENTS. — 16-page illustrated catalogue giving details of a range of electrical instruments for carrying out tests on motor vehicles. Particulars are included of battery testers, ignition testers, compression testers and devices for checking carburettors and fuel pumps and equipment for aligning and adjusting headlamps.—**Crypton Equipment, Ltd.,** Bridgwater, Somerset.

Leaflets illustrating and describing a new range of panel mounting circular scale miniature instruments with 2 and 2½in dials.—**Crompton Parkinson, Ltd.,** Crompton House, Aldwych, London, W.C.2.

Illustrated booklet giving details of a range of valve voltmeters.—**Marconi Instruments, Ltd.,** St. Albans, Herts.

Illustrated leaflet dealing with a test set for locating the position of breaks or short-circuits in sheathed multiple conductor cables. Included on the leaflet are details of other equipment in the company's range.—**Whiteley Electrical Radio Co., Ltd.,** Radio Works, Mansfield, Notts.

Leaflet (93) dealing with the "Guardion" corrosion voltmeter for use in connection with cathodic protection equipment.—**F. A. Hughes & Co., Ltd.,** 4, Stanhope Gate, London, W.1.

METAL PROTECTION.—Pamphlet (197) dealing with the "Norton Rokide" coating process for thermal, erosion and electrical protection of metal and other surfaces.—**Norton Grinding Wheel Co., Ltd.,** Welwyn Garden City, Herts.

SILICONE-GLASS LAMINATES. — 12-page booklet illustrating and describing the properties of silicone resin bonded glass-cloth laminates and illustrating typical applications of the use of this material in the electrical industry.—**Midland Silicones, Ltd.,** 68, Knightsbridge, London, S.W.1.

SOUND EQUIPMENT.—Illustrated catalogue (C/PA.26) describing a range of accessories for use with the company's microphones.—**Standard Telephones & Cables, Ltd.,** Connaught House, Aldwych, London, W.C.2.

SWITCHES. — Illustrated broadsheet giving prices and particulars of the "Castelco" range of switches.—**Castelco (Great Britain), Ltd.,** Castle Works, High Street, Old Woking, Surrey.

TELEPHONE EQUIPMENT.—Brochure giving particulars of the "Ansafone" automatic telephone answering unit.—**Tele-Nova, Ltd.,** 73, Great Peter Street, Westminster, London, S.W.1.

Brochure (1422) describing "Strowger" 25-50 line operator-attended private automatic branch exchanges, and brochure (1461) dealing with a 2-5 exchange connected intercom.—**Automatic Telephone & Electric Co., Ltd.,** Strowger House, Arundel Street, London, W.C.2.

TERMINAL STRIPS.—Leaflet and price list dealing with the company's range of terminal strips and connectors.—**Elkay Electrical Manufacturing Co., Ltd.,** 42, Woburn Place, London, W.C.1.

TRANSMISSION EQUIPMENT.—Booklet (C/4006) giving details of a three-circuit open-wire carrier system and a pamphlet (C/2040) listing information in tabular form on the number of channels, the frequency band and special features of transmission systems produced by the company.—**Standard Telephones & Cables, Ltd.,** London, E.16.

WELDING SETS.—Bulletin (101) illustrating and describing 15 and 20 kVA heavy duty industrial spot welders.—**W. D. Vick, Ltd.,** 28, Station Road, Birmingham, 27.

WIRES AND CABLES.—Leaflets giving particulars of heat resisting asbestos flexibles and cables and "Manganin" and "Manginsax" resistance wires and strips.—**Saxonia Electrical Wire Co., Ltd.,** Roan Works, Greenwich, S.E.10.

WIRING ACCESSORIES.—Leaflet (249) illustrated in colour and describing a range of 20 A switches designed for the control of water heating installations and a pamphlet dealing with a re-designed 13 A fused-plug.—**M.K. Electric, Ltd.,** Wakefield Street, Edmonton, London, N.18.

44-page illustrated and priced catalogue (W.950) covering the "Wylex" range of switch and fusegear and other wiring accessories.—**George H. Scholes & Co., Ltd.,** Wythenshawe, Manchester, 22.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Brisbane City Council. 9th October. Street lighting lanterns and auxiliaries. (E.S.B. 21551/59. Ten/41850.)*

Director, Stores and Contracts, Postmaster General's Department, Melbourne. 13th October. Uniselector maintenance parts. (E.S.B. 21833/59. Ten/41936.)* Radio receiving station equipment. (E.S.B. 21834/59. Ten/41931.)* 15th October. Plugs and covers. (E.S.B. 21831/59. Ten/41937.)* 20th October. Telephone parts and accessories. (E.S.B. 21832/59. Ten/41932.)*

State Electricity Commission of Western Australia, Perth. 19th November. 5,000 kVA and 3,000 kVA capacitors. (E.S.B. 21645/59. Ten/41865.)*

Western Australian Government Tender Board, Perth. 132 kV, 2,500 MVA switchgear. (E.S.B. 21917/59. Ten/41967.)*

Belfast.—Northern Ireland Ministry of Finance. 6th October. Electrical installation in rearing house, etc., at Loughry Agricultural College, Cookstown, Co. Tyrone. Ministry of Finance Room 103, Law Courts Building.

Incorporated Cripples' Institutes. 23rd October. Electric lift installation at the Stewart Memorial School, Bangor, Co. Down. G. R. Twist, architect, 141, Scottish Provident Buildings, Belfast.

Birmingham.—Birmingham, Tame and Rea District Drainage Board. 26th October. Improvements and extensions to electrical distribution at Minworth. (See this issue.)

Ceylon.—Tender Board, Ministry of Transport and Power, Colombo. 7th October. 11 kV and l.v. armoured cable. (E.S.B. 21701/59. Ten/41896.)* 14th October. Electric lamps. (E.S.B. 21749/59. Ten/41910.)*

Croydon.—Corporation. 9th October. Power plug sockets and other electrical work in 222 pre-war Council houses. (See this issue.)

Down.—County Education Committee. 1st October. Electrical installation in the central meals kitchen at Dromara, Co. Down. J. R. W. Murland, consulting engineer, 13, Wellington Place, Belfast.

Formosa.—Central Trust of China, Taipei. 8th October. Mine ventilating equipment and hoist, six 100 kVA transformers and rock drilling machines. (E.S.B. 21457/59/I.C.A. Ten/41793.)* Electric armoured power cables and steel pipe. (E.S.B. 21456/59/I.C.A. Ten/41794.)* 12th October. Mine ventilating fan, hoists, cable and transformers. (E.S.B. 21882/59/I.C.A. Ten/41951.)*

Hoddesdon.—U.D.C. 2nd October. Installation of thirty 140 W sodium lighting points in Hertford Road. U.D.C. surveyor, Woodlands, High Street.

India.—Madras State Electricity Board. 30th September. Power and control cables and cable boxes. (E.S.B. 21468/59. Ten/41860.)*

National Coal Development Corporation, Ltd., Calcutta. 26th October. Power cables. (E.S.B. 21485/59. Ten/41835.)* Oil circuit-breakers. (E.S.B. 21486/59. Ten/41829.)* 4th November. Cable. (E.S.B. 21484/59. Ten/41827.)*

India Supply Mission, Washington, D.C., U.S.A. 27th October. Power station plant, including water tube boiler, turbo-alternator, overhead crane, wagon tippler, shunting diesel locomotives, switchgear and cooling tower equipment. (E.S.B. 21706/59/I.C.A. Ten/41924.)* 28th October. 15,000 insulator sets. (E.S.B. 21708/59/I.C.A. Ten/41921.)*

Iraq.—Directorate of Contracts and Purchases, Ministry of Defence, Baghdad. 7th October. 8,220 batteries. (E.S.B. 22335/59. Ten/42087.)*

Littlehampton.—U.D.C. 19th October. Electrical installations in twenty old people's flats in Edinburgh Parade. Surveyor, U.D.C. Offices.

Londonderry.—2nd October. Electrical installations at the St. Eugene's Convent Girls' and Infants' Schools. Varming & Mulcahy, consulting engineers, 37, Malone Road, Belfast.

Ludlow.—Corporation. 12th October. Sodium discharge street lighting. (See this issue.)

Matlock.—U.D.C. 19th October. Trunk road Group "A" lighting equipment. (See this issue.)

New Zealand.—Dunedin Corporation. 13th November. 6·6 kV, 250 MVA switchgear and protective equipment. (E.S.B. 21361/59. Ten/41855.)* Four 15 MVA transformers. (E.S.B. 21362/59. Ten/41854.)*

New Zealand Electricity Department, Wellington. 19th January. Two 60,000 kVA synchronous condensers. (E.S.B. 21976/59. Ten/41970.)*

Rostrevor.—1st October. Electrical installation in Convent Primary School. C. P. MacNally, consulting engineer, 143, Royal Avenue, Belfast.

Skipton.—U.D.C. 5th October. Street lighting equipment. (See this issue.)

South West Africa.—Tender Board, South West African Administration. 9th October. Electrical food conveyors, toasters, heaters, polishers, refrigerators and vacuum cleaners. (E.S.B. 21942/59. Ten/41994.)*

Sudan.—Sudan Railways Stores Department, Atbara. 15th October. A.c. motors. (E.S.B. 21987/59. Ten/41968.)*

Thailand.—Thai Technical and Economic Committee, Bangkok. 12th October. Oil immersed transformers ranging from 100 kVA to 333 kVA. (E.S.B. 21762/59. Ten/41944.)*

United States.—U.S. Army Engineer District, Portland, Oregon. 20th October. 15,789 kVA generator. (E.S.B. 21974/59. Ten/41965.)*

ORDERS PLACED

Bedford.—Corporation Parks, Cemeteries and Public Buildings Committee. Rewiring of electrical installation at the Corn Exchange (£1,115).—Cawdells of Luton.

Glasgow.—Corporation Museums and Art Galleries Committee. Installation of 190 fire detectors with indicator board in the Kelvingrove Art Gallery and Museum (£1,805).—Associated Fire Alarms.

Huntingdonshire.—County Council. Supply and erection of 22 steel street lighting columns complete with cut-off lanterns at the junction of the Great North Road with A.605 at Kate's Cabin.—Abacus Engineering.

Middlesex.—County Council Education Committee. Renewal of the electrical installation at the Residential Special School at Elmers Court, Lymington, Hants (£1,050).—F. W. Cook (Southampton).

Nottingham. — City Council. Recommended. Installation of electrical radiant heating at the Central Market (£7,074).—Blackburn, Starling & Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aldershot.—St. Michael's C.E. secondary school; county architect, The Castle, Winchester.

Ashby.—Houses (56); U.D.C. surveyor.

Billingham-on-Tees.—R.C. primary school; Thomas A. Crawford, architect, 80, Borough Road, Middlesbrough.

Brierley Hill.—Houses (128), Market Street; Building & Equipment, Ltd., 55, Darlington Street, Wolverhampton.

Bristol.—Multi-storey parking garage, Rupert Street/Lewins Mead site (£300,000); Underwood & Mander, consulting engineers, 18, Regent Street, Bristol, 8.

Cambridge.—First stage of new hospital, Hills Road; Kerridge, Ltd., builders, 26/46, Sturton Street.

Cardiff. — Multi-storey showrooms and offices, Wood Street; Ruislip Development Co., Ltd., 56, Grosvenor Street, London, W.1.

Cheltenham.—Two-storey extension to printing works for Taylor Young (Printers), Ltd.; L. W. Barnard & Partners, architects, 13, Imperial Square.

Chester.—Multi-storey flats, Newtown area; city surveyor.

Dundee.—15-storey flats, schools, shopping area, churches, etc., as development of Menzieshill housing scheme; R. Dron, city architect, 17, City Square.

Eccles.—Flats (240), Cawdor Street/Trafford Road site; town clerk, Town Hall Annexe, Irwell Place.

Edinburgh.—Third development, Ainsley Park Secondary School; A. Steele, city architect, City Chambers, High Street.

Egham.—Flats and bungalows (33), Bond Street, Englefield Green, for U.D.C.; H. R. H. Smith, clerk, Council Offices, 155, High Street, Egham, Surrey.

Guildford.—Works, Woodbridge Meadows estate; Dowdeswells, Ltd., Rodboro Buildings, Bridge Street.

Hadley Wood.—Houses (104), Waggon Road and Monkey Mead; Lawdon Partners, Ltd., 157, Victoria Street, London, S.W.1.

Haverhill.—Four unit factories, Colne Valley industrial estate, Bumpstead Road; J. C. Myers, architect, High Street, Haverhill, Suffolk.

Huntingdon.—School, Oxmire Lane; county architect, Huntingdon.

Houses (26), Sapley Road; T. Henderson, Huntingdon.

Kenton.—R.C. church, Kenton Road; John E. Sterrett, architect, 21a, Ashley Place, London, S.W.1.

London.—Underground garage, Finsbury Square; Shingler & Risdon, architects and engineers, 47, Bedford Row, W.C.1.

Block of flats, Abbey Road and Priory Road, Kilburn; Wilson, Lovatt & Sons, Ltd., 16, Grosvenor Crescent, S.W.1.

Factory, Barretts Green Road, Willesden; F. T. Morrell & Co., Ltd., 330, Old Street, E.C.1.

Houses (246), Smithy Street housing scheme, Stepney; Riches & Blythin, architects, 16, Northumberland Avenue, W.C.2.

Longbenton (Northumberland). — R.C. primary school; A. Anderson, Ltd., contractors, Stanmore Road, Newcastle-on-Tyne.

Long Eaton.—Houses (61), Draycott Road, Sawley; F. Turner, surveyor, Town Hall, Long Eaton, Derbyshire.

(Continued on next page)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT *(continued)*

Maidstone.—Additional ward accommodation, West Kent General Hospital; Thomas Mitchell & Partners, architects, 20, Bedford Square, London, W.C.1.

Manchester. — Nine-storey office block, Fountain Street; Unicos Property Co., Ltd., 43, North Audley Street, London, W.1.

Newcastle-on-Tyne. — Redevelopment scheme in the Scotswood Road area providing for large blocks of flats (£10 million); city architect, 18, Cloth Market.

New college for Northern Counties Training College of Cookery and Domestic Science; Waring & Netts, architects, 36, Jesmond Road.

North Riding.—Secondary school, Loftus; county school architect, County Hall, Northallerton.

Oldbury.—Flats and maisonnettes (57), Titford estate, Whiteheath; T. Dunkley Hogg, architect, 1, Church Street.

Port Talbot.—Houses (100), Aberavon; G. V. Griffiths, borough engineer, Municipal Buildings, Port Talbot.

Redcar.—Fire and ambulance station; county architect, County Hall, Northallerton.

Ross and Cromarty.—Erection of new Hilton of Cadboll School; Fairbairn, Lightbody & Cownie, 53, Queen Street, Edinburgh.

Rugby.—Four blocks of flats, Rokeby estate; Bosworth & Wakeford, Ltd., Lawford Road.

Rugeley. — Houses (142), Ravenhill; Gregory Housing, Ltd., 21, Farncombe Road, Worthing.

Scunthorpe.—Fire and ambulance station (£67,000); county architect, Lincoln.

Southampton.—Flats (194), Northam area; borough engineer.

Southend-on-Sea.—Old people's hostel, Whittingham Avenue; borough architect.

South Shields.—Crematorium, West Simonside; J. Reid, borough engineer.

Stamford.—Junior and infants' school, Kesteven Road; Edward Craven, architect, 3, St. Mary's Place.

Stratford-on-Avon.—Office block, Ely Street; Joseph Webb & Co., Ltd., Queen's College Chambers, Birmingham.

Sunderland.—Houses (336), Town End Farm estate; L. W. Evans (Contractors), Ltd., 18, Norfolk Street.

Swansea.—New chemistry, physics and metallurgy blocks at Mount Pleasant Technical College; borough architect, The Guildhall.

Covered market; Sir Percy Thomas & Son, architects, 104, Walter Road.

Taunton.—Long-term scheme for development of Taunton Market (£130,000); borough engineer.

Teddington.—Modernisation of Normansfield Hospital; F. A. C. Maunder, architect, 40, Eastbourne Terrace, London, W.2.

Tottenham.—Flats (60), Tewkesbury estate, and old people's dwellings (24), Talbot Close; borough engineer, Town Hall, N.15.

Trawsfynydd.—Temporary township for workmen on the atomic power station; Medway Buildings & Supplies, Ltd., Phœnix Wharf, Rochester.

Truro.—Hospital; Adams, Holden & Pearson, architects, 38, Gordon Square, London, W.C.1.

Wealdstone.—Eight shops, with offices over, Headstone Drive; Investment & Securities Trust, Ltd., 28, Great Ormond Street, London, W.C.1.

West Sussex.—County buildings at Crawley, including police station and section house, court house, library, offices and ambulance station; T. C. Hayward, clerk to C.C., County Hall, Chichester.

Whiston.—Dwellings (302), Sugar Lane, Knowsley; Roy & Partners, Ltd., 64, Blackfriars Road, Manchester.

Worcester.—First instalment of teachers' training college; Holland W. Hobbiss & Partners, architects, 36, Waterloo Street, Birmingham, 2.

Worthing.—Flats (40), Field Place estate; Heavon Holdings, Ltd., 62, Marine Parade.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 28th SEPTEMBER

Cowley.—A.S.E.E. Oxford and District and Reading and District Branches, 2 p.m. Visit to Morris Motor Works.

Leeds.—Houldsworth School of Applied Science, The University, 7.30 p.m. Institution of Plant Engineers, West and East Yorkshire Branch. "Operational Research," by G. D. Jordan.

Watford. — Compass Hotel, 8.15 p.m. A.S.E.E. North West London Branch. "Composition of the A.S.E.E.", by W. J. Wheeler.

TUESDAY, 29th SEPTEMBER

Cambridge. — Engineering Laboratory, Trumpington Street, 8 p.m. I.E.E. Cambridge Electronics and Communications Group. Chairman's address. "The Uses of Network Theory," by Dr. K. F. Sander.

Leicester.—Westcotes Constitutional Club, off Narborough Road, 7.30 p.m. A.S.E.E. Nottingham Branch. Social evening.

London.—Manson House, 26, Portland Place, W.1, 7 p.m. Society of Instrument Technology, Control Section. "An Engineer's Approach to a Servo Problem," by H. Clausen.

WEDNESDAY, 30th SEPTEMBER

Lemington-on-Tyne.—Institution of Plant Engineers, North East District. Visit to G.E.C. Osram glass works.

London.—London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers. "Microwave Valves: A Survey of Evolution, Principle of Operation and Basic Characteristics," by W. E. Willshaw and C. H. Dix.

Treforest.—Glamorgan College of Technology, 6.30 p.m. British Institution of Radio Engineers, Treforest Branch. "The Use of Demonstration Equipment in Basic Radio Theory," by H. Henderson.

THURSDAY, 1st OCTOBER

Glasgow.—Institution of Plant Engineers, Glasgow Section. Ladies' night.

Southampton.—A.S.E.E. Reading Branch. Visit to Esso Refinery, Fawley.

FRIDAY, 2nd OCTOBER

Fawley.—Administration Building, Esso Refinery, 5.30 p.m. Society of Instrument Technology, Fawley Section. "Feedback," by R. S. Medlock.

Liverpool.—Industrial Development Centre, M.A.N.W.E.B., Paradise Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. "The National Inspection Council—Its Aims and Objects," by E. J. Sutton.

London.—Park Lane Hotel, Piccadilly, W.1, 7 p.m. Electrical Trades' Commercial Travellers' Association. Annual ball.

Pepys House, 14, Rochester Row, Westminster, S.W.1, 7 p.m. Junior Institution of Engineers. Film evening.

SATURDAY, 3rd OCTOBER

London.—White Hall Hotel, Bloomsbury Square, W.C.1, 9.30 a.m. A.S.E.E. Organisation Committee meeting.

SATURDAY, 3rd OCTOBER to THURSDAY, 8th OCTOBER

London.—Olympia. International Bakers' and Confectioners' Exhibition.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 16th October:

Tern. No. 787,909. Class 7. Spin drying machines, washing machines and parts.—Tern Electrics, Ltd., 50, Newgate Lane, Mansfield, Notts.

Orex. No. 784,686. Class 9. Excitation apparatus (not being machines) for alternators, incorporating rectifiers and single- or three-phase air-gapped current transformers; and parts.—Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough, Leics.

Raydyot. No. 785,717. Class 9. Cigarette lighters, plug and socket switches, storage batteries and cells, connectors, resistances, cut-outs (circuit-breakers), terminals, contacts and conductors, all being electric; electrical apparatus for controlling lighting and signalling circuits; and flashing signal lamps for vehicles. **Raydyot.** No. 785,718. Class 11. Space heaters and stoves, all being oil-burning or electric; immersion heaters, parking lamps for vehicles, lighting installations for vehicles, lamp bulbs, fans and torches, all being electric; apparatus employing heat for preventing the formation of mist on vehicle wind screens; reflectors (vehicle); and cowls and masks, all for vehicle lamps.—James Neale & Sons, Ltd., 68, Graham Street, Birmingham, 1.

Micon. No. 785,849. Class 9. Electric accumulators and electric batteries and parts.—Ebonite Container Co. (Manufacturing), Ltd., Tileyard Road, York Way, London, N.7.

Torvac. No. 787,545. Class 9. Electric semiconducting devices.—Tottenham Radio Valve Co., Ltd., West Road, Tottenham, London, N.17.

Electro-Mist. No. 776,315. Class 11. Electrically operated air purifying apparatus; electrical air filters (not being parts of engines, motors or machines); electric fans; and electrically operated ventilating apparatus.—American Air Filter Co., Inc., Louisville, Kentucky, U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5 to 9, Quality Court, Chancery Lane, London, W.C.2.

Woolite. No. 784,598. Class 11. Electric lighting fittings and electric lamps, but not including lampshades.—Osborn Manufacturing Co., Ltd., 5-13, Highgate Square, Birmingham, 12.

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